Leaf and Yard Waste Diversion Strategy Feasibility Study

Final Report

August, 2010

Wildcat
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Leaf and Yard Waste Diversion Strategy Feasibility Study

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August, 2010

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1 Introduction

In 2006, Alberta Environment formed a Leaf and Yard Waste Technical Committee (the Committee) to assist in the identification of best practices and development of policy recommendations to divert leaf and yard waste to a beneficial use.

Individuals were appointed to the Committee by Alberta Environment, based on their knowledge and experience in small and large municipal composting operations, regional representation, and willingness to consider a broad range of tools to divert leaf and yard waste (L&YW). As a result, the Committee represented organic waste and municipal waste specialists, landfill specialists, institutional waste generators and facility managers/operators as well as Alberta Environment staff.

The Committee's initial work was completed in January of 2007, and was summarized in a document entitled "Proposal for a Leaf & Yard Waste Diversion Strategy" (Alberta Environment, 2007). The Committee recommended that a province-wide L&YW strategy consist of the following key elements:

- A sustainable grant program to fund the province wide development of resource recovery infrastructure that is build through a surcharge on tipping fees of waste disposed of at landfills and a one-time provincial endowment contribution.
- A disposal ban on leaf and yard waste, beginning with leaf litter, grass, and garden waste.
- A communication, education, and training program to educate key stakeholder groups.
- Development of procurement policies by the Government of Alberta to increase government consumption of compost.

Implementation of a standardized waste measurement system and an "accountability system" by Alberta Environment so that the success of the Strategy can be tracked and improved.

In 2009, the Project Team, consisting of personnel from CH2M HILL, R.Alexander Associates, sonnevera international corp., and the University of Alberta, was retained to research and compile background information needed to finalize the L&YW Diversion Strategy. As part of this assignment, the Project Team was also asked to review the program recommendations put forward by L&YW Diversion Technical Committee.

During the course of the project, a number of technical memoranda were prepared that focused on specific information requirements identified by the L&YW Technical Committee. These reports were subsequently updated based on additional information and comments provided by the Committee, and have been consolidated into this summary report.

2 Existing L&YW Quantities and Infrastructure in Alberta

Leaf and yard waste (L&YW) is a term used to broadly capture a range of materials. The definition adopted by the L&YW Diversion Technical Committee includes "vegetative matter resulting from gardening, horticulture, agriculture, landscaping or land clearing operations, including materials such as tree and shrub trimmings, plant remains, grass clippings, leaves, trees and stumps."

From this definition, it is apparent that there are many sources of L&YW. The most common source is single-family homes. However L&YW is also generated by multi-family complexes (i.e. apartments and condominiums), retail developments, business complexes, schools, hospitals and other institutions, golf courses, municipal parks and sports fields.

Leaf and yard wastes are generally a very clean and contaminant free feedstock. As a result, many regulatory agencies in North America have relaxed the permitting requirements for yard waste composting facilities, and the product distribution limitations on compost made from leaf and yard waste. However, contamination can still be problematic. Some of the common contaminants that are found in leaf and yard waste include plastic bags, pet wastes, dirt and sod, rocks, and fertilizer containers.

2.1 L&YW Quantity Estimates

For solid waste planning studies, it is a common practice to arrive at estimates of specific waste quantities based on the use of per capita waste generation or waste disposal rates, waste composition data, and census data. In the case of estimates prepared for large regions, there is often an absence of detailed weight records, and therefore it is necessary to apply measured per capita rates from one portion of the region across other areas.

2.1.1 Per Capita Rates

For the purpose of this project, per capita waste generation rates for municipal solid wastes were obtained from a study and spreadsheet model of overall solid waste quantities prepared by EBA Engineering Consultants Ltd. under contract to Alberta Environment (EBA, 2007). The model provided per capita waste generation rates for large and small urban centers and rural areas, as well as a breakdown of the relative contribution of major sectors (i.e. residential, ICI and construction and demolition) to the generation rate. In developing the spreadsheet model, EBA looked at a range of data sources from Alberta Environment and from specific municipalities. The final approach used to develop the model was to choose specific municipalities (for which comprehensive data was available) to represent other similarly sized municipalities. For example, data from Okotoks was used to model communities with populations of between 10,000 and 80,000, and Strathmore was used to model communities with populations of between 1,000 and 10,000. Hussar was deemed representative of rural regions and smaller communities with populations less than 1,000. Model inputs for Edmonton and Calgary were much more available, and were obtained from specific studies completed in those two areas.

A summary of the per capita waste generation rates from the EBA model which were subsequently adopted for this study are summarized in Exhibit 2-1.

EXHIBIT 2-1

SUMMARY OF PER CAPITA WASTE GENERATION RATES (EBA, 2007)

Municipality Type	Source Data	Total MSW Generation Rate (tonnes/capita per year)	Res. Waste Generation Rate (tonnes/capita per year)	ICI Waste Generation Rate (tonnes/capita per year)	C&D Waste Generation Rate (tonnes/capita per year)
Edmonton/Calgary		1.38	0.520	0.770	0.090
Large Urban Areas (10,000 to 100,000 pop)	Okotoks, AB	0.68	0.138	0.417	0.124
Small Urban Areas (1,000 to 10,000 pop)	Strathmore, AB	0.92	0.161	0.530	0.229
Rural Areas and Towns (less than 1,000 pop.)	Hussar, AB	2.07	0.200	0.715	1.155

The generation rates provided in the EBA study were presented on an "as generated" basis, as opposed to an "as disposed" basis", which would factor in the influence of existing diversion programs. However, since not all L&YW that is generated is collected and centrally managed (i.e. some is mulched or composted at a backyard level), it has been surmised the L&YW per capita rates in the EBA study more accurately represent "as disposed" rates.

2.1.2 Municipal Waste Composition

Estimates of the amount of L&YW and other components of the solid waste from each sector can be made using detailed data from solid waste composition studies During a waste composition study, representative samples of solid waste from a source (e.g. residential, commercial, institutions) are obtained and manually sorted into major fractions (e.g. paper, plastic, food waste, textiles). The weights of the various fractions are tabulated, and the overall composition of the waste is calculated on a percentage basis.

Solid waste composition studies that are statistically valid are very costly to undertake and thus are not commonly done outside of major population centers. Also, in order to accurately reflect the waste composition, a study must include sampling intervals in at least the winter and summer seasons to account for seasonal fluctuations in L&YW quantities.

In Alberta, large-scale composition studies have been done by the City of Calgary and City of Edmonton, but only a limited number of studies have been completed in other urban areas (e.g. Medicine Hat, Jasper, Edson). Of these latter studies, none have included enough sampling intervals to account for seasonal L&YW variations. Composition studies in small towns, villages and rural areas are very uncommon, and only one study (i.e. in the Stettler area) is known to have been completed in Alberta.

As part of the development of the spreadsheet model for Alberta Environment, EBA undertook a review of available composition data from Alberta and other jurisdictions. The composition data ultimately used by EBA in their spreadsheet model for the residential and ICI waste streams is summarized in Exhibit 2-2.

EXHIBIT 2-2

L&YW COMPOSITION BY WASTE TYPE

Municipality	Field Program Details	Residential Waste Stream (% of total)	ICI Waste Stream (% of total)
EBA Provincial Model (2007) [1]			
Edmonton/Calgary	Based on previous studies	5.54	4.81
Urban Area		9.81	3.40
Small Urban Areas		8.98	3.05
Rural Areas		8.75	6.46
City of Calgary			
Single-family Residential (2004) [2]	Field sampling in Jun & Nov. Data consolidated using tonnage weighting factors.	22	–
Multi-family Residential (2004) [2]		6.6	–
Residential (1999) [2]	N/A	24.0	–
IC&I (2005) [3]	Based on previous studies		N/A [4]
City of Edmonton (2000/2001) [5]			
Single-family	Field sampling in Jun, Aug, Oct, Jan & Apr. Data consolidated using ratio method.	35.1	–
Multi-family		12.3	–
Stettler Area (1991/1992) [6]			
Town of Stettler, Residential	Field sampling in Oct, Jan, May & Jul. Data consolidated using averages.	16.9	1.6
Big Valley, Residential		3.5	–

Notes:

1. EBA Engineering Consultants Ltd., Diversion Infrastructure Requirements for 2010 Pollution Prevention and Conservation, June 2007.
2. CH2M HILL Canada Ltd., City of Calgary 2004 Residential Waste Composition Study, May 2005.
3. EBA Engineering Consultants Ltd., City of Calgary ICI/C&D Waste Characterization Study, January 2006
4. L&YW was not broken out from other organic waste types.
5. City of Edmonton, Unpublished internal report, 2001
6. GCG Dillon Ltd., Stettler Integrated Waste Management Study, December, 1993.

At the outset of this project, the L&YW composition data from the EBA model was compared to published composition data from the City of Calgary, City of Edmonton and from the Stettler region. Data from these three sources is also summarized in Exhibit 2-2. Composition studies from other Alberta jurisdictions were not considered due to their limited scope (i.e. lack of seasonality). Composition studies from British Columbia were also not considered due to the dissimilarities in vegetation between that province and Alberta.

As expected, the composition data from the various sources varied, and it is difficult to arrive at conclusions as to which is the most representative of actual conditions. Based on the comparison, it was ultimately decided that the study completed by the City of Edmonton would be used as the basis for estimating residential L&YW quantities, and the composition data contained in the EBA model would be used as the basis for ICI L&YW quantity estimates.

2.1.3 L&YW Quantity Estimates

Using the per capita rates and composition data, along with 2008 provincial census data, a simplified spreadsheet model was developed for this project. The spreadsheet model allowed for estimates of L&YW quantities in each municipality to be developed. These estimates were then consolidated on a regional basis using the seven geographic regions from Alberta's Land Use Framework (see Exhibit 2-3).

A summary of the L&YW quantity estimates for each region are provided in Exhibit 2-4. To further allow for prioritizing programs, the separate estimates have been provided for L&YW originating from residential and ICI sources.

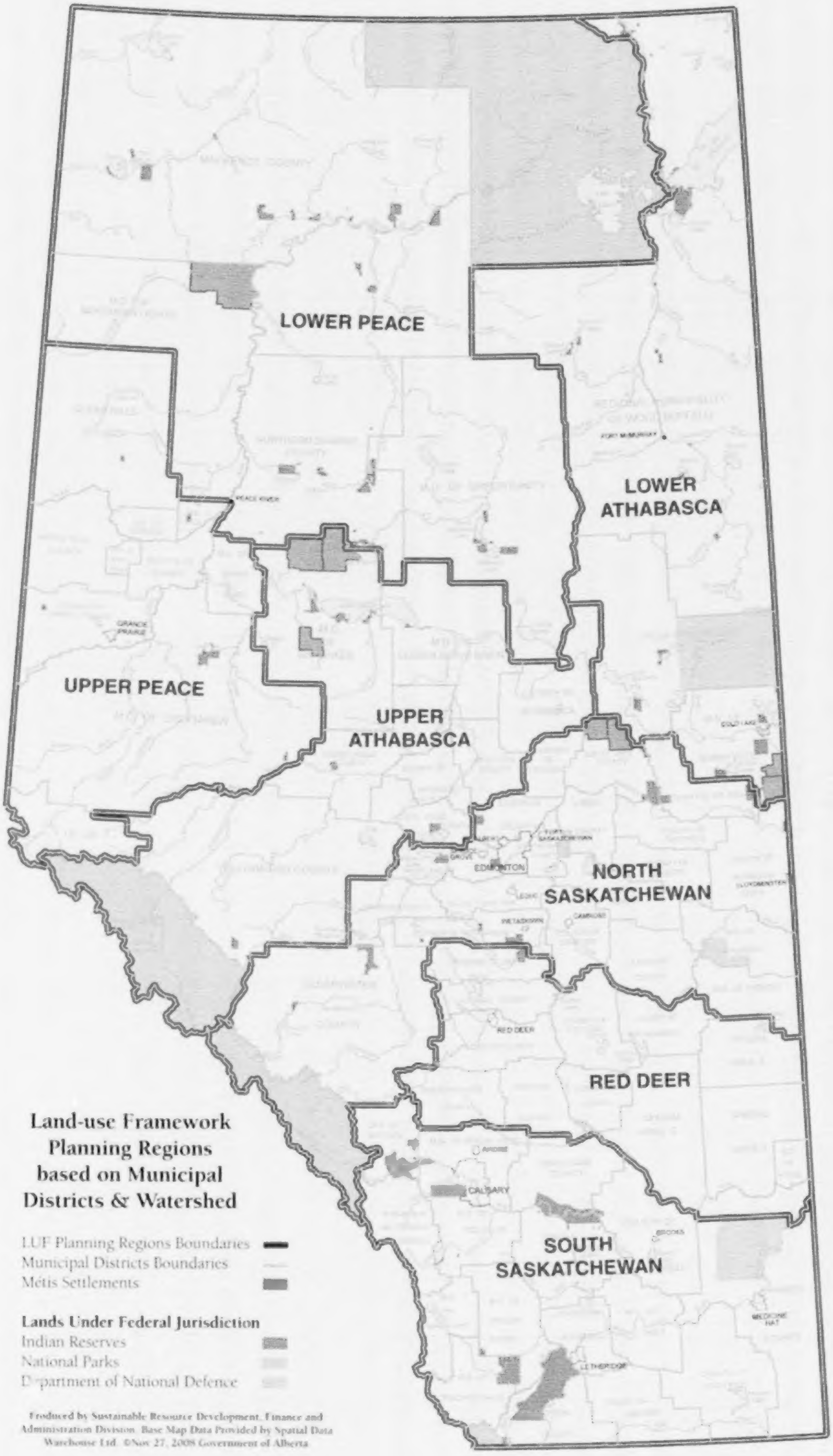

LOWER PEACE
FORT McMURRAY
LOWER ATHABASCA
PEACE RIVER
GRANDE PRAIRIE
UPPER PEACE
UPPER ATHABASCA
COLD LAKE
FORT SASKATCHEWAN
EDMONTON
NORTH SASKATCHEWAN
LLOYDMINSTER
LEDUC
WETASKIWIN
CAMROSE
RED DEER
RED DEER
AIRDRIE
CALGARY
BROOKS
SOUTH SASKATCHEWAN
MEDICINE HAT
LETHBRIDGE
Land-use Framework Planning Regions based on Municipal Districts & Watershed
LUF Planning Regions Boundaries
Municipal Districts Boundaries
Métis Settlements
Lands Under Federal Jurisdiction
Indian Reserves
National Parks
Department of National Defence
Produced by Sustainable Resource Development, Finance and Administration Division. Base Map Data Provided by Spatial Data Warehouse Ltd. ©Nov 27, 2008 Government of Alberta

EXHIBIT 2-3
LAND-USE FRAMEWORK PLANNING REGIONS

EXHIBIT 2 4

SUMMARY OF "AS DISPOSED" L&YW QUANTITIES BY GEOGRAPHIC REGION

Region	Population	Residential L&YW (tonnes/yr)	ICI L&YW (tonnes/yr)
North Saskatchewan	1,281,139	151,311	40,917
South Saskatchewan	1,531,318	200,646	49,855
Red Deer	274,784	15,147	6,826
Lower Athabasca	131,786	6,476	2,619
Upper Athabasca	119,039	7,410	3,815
Lower Peace	41,291	2,617	1,359
Upper Peace	116,946	6,588	3,091
Total	**3,496,303**	**390,195**	**108,482**

2.1.4 Regional Variations in L&YW Quantities

One goal of this assignment was to quantify the variations in L&YW quantities between the various regions in Alberta; it was supposed that the amounts of L&YW generated/collected in the drier southern regions of the province would be less than in the central and northern areas.

However, as the study progressed, it because apparent that there was insufficient data to allow for a quantitative assessment of regional differences in quantities.

2.2 Factors Affecting L&YW Quantities

More than any other component of the solid waste stream, L&YW quantities vary during the course of the year. The magnitude of this variation is shown graphically in Exhibit 2-5 which shows the month-by-month variation in tonnages collected through the City of Red Deer's curbside L&YW program in 2008. L&YW quantities can also vary from year to year within the same area. Intuitively, these variations can be attributed mainly to climatic variations which directly affect rate of growth of grass and trees. The primary factors would be variations in temperatures, precipitation, and hours of sunlight.

Climatic variations are offset somewhat in urban settings by irrigation and fertilization practices. For example, the effects of a dry summer season on residential lawns can be offset by watering on a regular basis. Generally (but not exclusively) rural developments which obtain water from wells are less likely to irrigate lawns.

The type of grass, shrubs and trees using in landscaping applications, and the types of native trees can also affect L&YW quantities. For example, deciduous trees common in developments throughout most of the province will contribute more to L&YW quantities than coniferous trees in the western (i.e. mountainous) areas.

(Source: City of Red Deer Residential L&YW Collection Program, 2008)

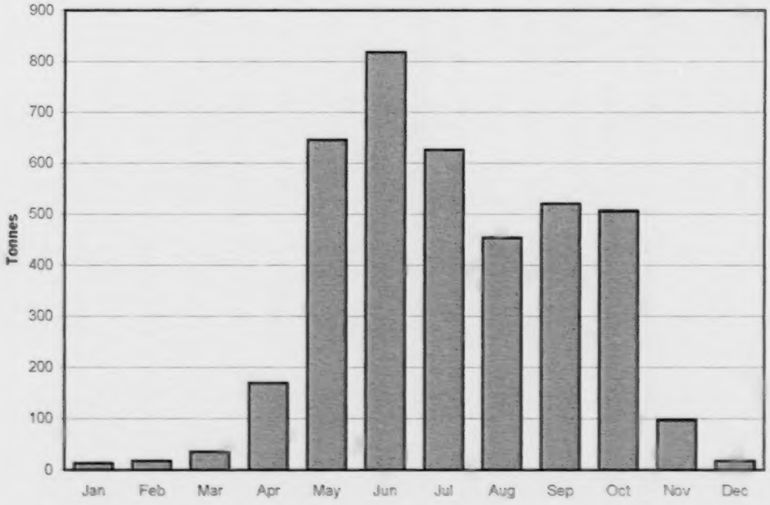


EXHIBIT 2-5

TYPICAL SEASONAL VARIATIONS IN L&YW QUANTITIES

The age of a subdivision development, and the resulting maturity of trees used for landscaping, can lead to great variations in L&YW quantities within a municipality. For example, the amount of leaves generated by 50 to 75 year old trees in older neighbourhoods in Calgary and Edmonton (i.e. close to downtown) is significantly greater than the quantities in newer outlying subdivisions where trees are less than 10 years old.

Similarly, the amount and type of "green space" in a particular community will also affect the amount of L&YW attributed to municipal operations. There is generally less green space in smaller or older communities which are developed on a "grid pattern" of street, than in newer communities which are typically developed with non-grid road networks, neighbourhood trail systems, de-centralized schools, and more park areas.

Snowfall can also impact L&YW quantities, since snowfall contributes to soil moisture which affects growing conditions during the following season. Snowfall can also affect quantities in a less obvious manner. In Alberta, where fallen leaves are most often raked up in the late fall by home-owners, an early snowfall can disrupt leave collection activities and force it to be deferred to the following year. This will have the effect of reducing annual quantities in one year, and increasing it in the next. The delay can also increase seasonal peaks and affect a composting facility's processing capabilities.

Spring snow storms can also increase L&YW quantities. When snow storms happen late in the spring after trees have leafed out, there can be significant breakage of tree limbs from the weight of the snow.

Tree diseases and insect infestations (such as Dutch elm disease and pine bark beetle) can also affect the amount of L&YW generated. However, L&YW debris resulting from control of these diseases/infestations is often managed outside of the programs for other L&YW due to concerns over disease spread.

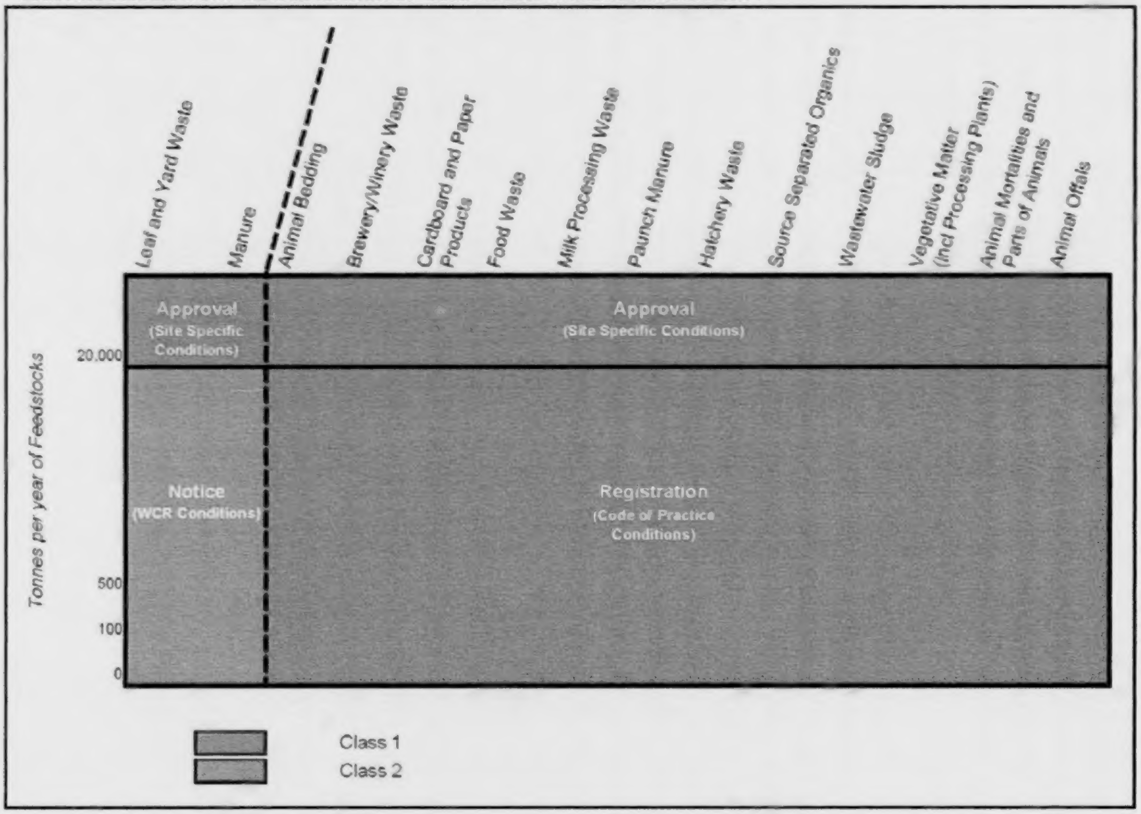
2.3 Alberta's Compost Facility Classification

2.3.1 Existing Classification System

As shown in Exhibit 2-6, composting sites in Alberta are currently categorized as either Class 1 or Class 2 facilities by Alberta Environment through the *Activities Designation Regulation*. Class 2 facilities are those which accept only manures and "vegetative matter". The latter term has historically been interpreted by Alberta Environment to include only leaf and yard waste, brush, and wood waste. Class 1 facilities are those which accept feedstocks not covered by Class 2 facilities. The most common feedstocks at existing Class 1 facilities include residential food waste, biosolids, food processing waste, and unsorted municipal solid waste (i.e. City of Edmonton co-composting facility).

EXHIBIT 2-6

EXISTING REGULATORY CLASSIFICATION OF COMPOSTING FACILITIES IN ALBERTA


Leaf and Yard Waste
Manure
Animal Bedding
Brewery/Winery Waste
Cardboard and Paper Products
Food Waste
Milk Processing Waste
Paunch Manure
Hatchery Waste
Source Separated Organics
Wastewater Sludge
Vegetative Matter (incl Processing Plants)
Animal Mortalities and Parts of Animals
Animal Offals
Approval (Site Specific Conditions)
Approval (Site Specific Conditions)
Notice (WCR Conditions)
Registration (Code of Practice Conditions)
Tonnes per year of Feedstocks
20,000
500
100
0
Class 1
Class 2

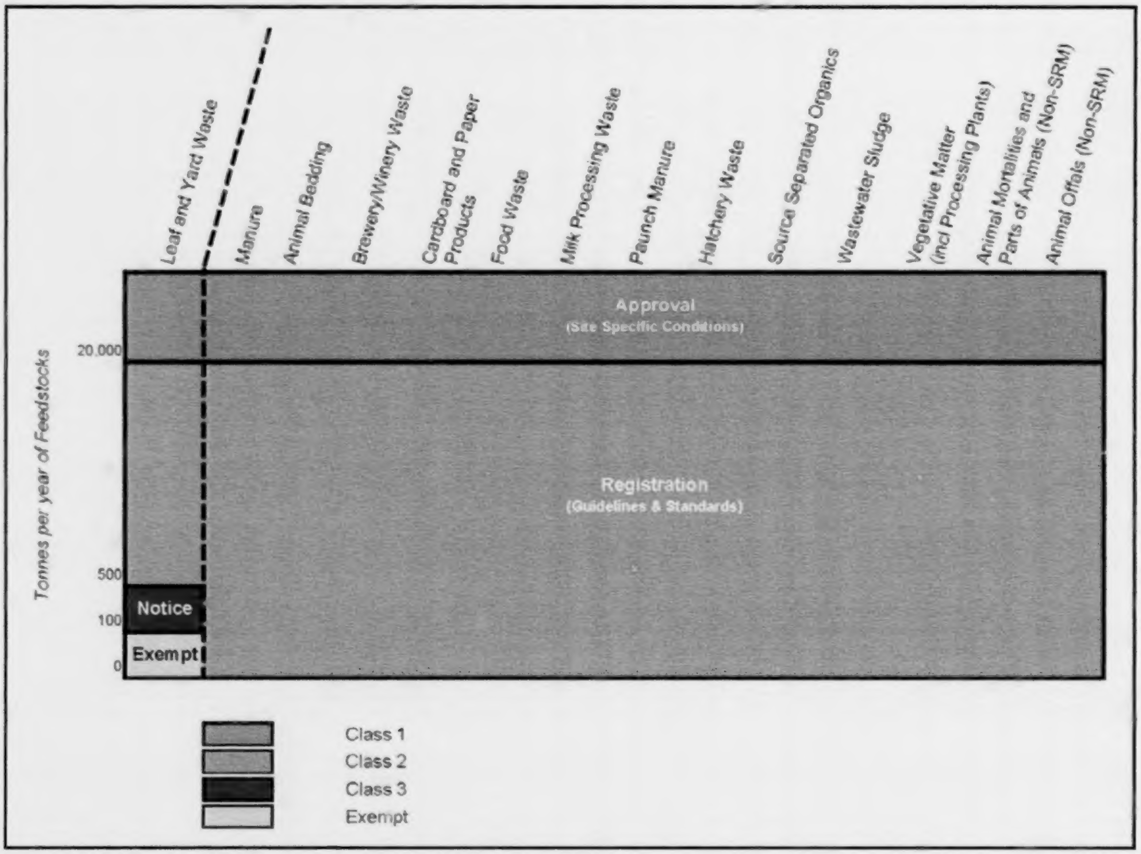
2.3.2 Proposed Regulatory Changes

Alberta Environment has been working towards updating the regulatory framework relating to composting facilities as part of larger review of the Waste Control Regulation. This review has been done with the involvement of public and private sector stakeholders from the Province's composting industry.

One outcome of the review process is a new classification and permitting scheme for composting facilities. The new classifications recognize the direction the industry has taken since the original regulations were developed in the late 1990's. Primarily, the new scheme expands the type of feedstocks that can be handled at Class 2 composting facilities. A graphical summary of the proposed new scheme is provided in Exhibit 2-7.

EXHIBIT 2-7

REGULATORY CLASSIFICATION AS PER DRAFT STANDARDS FOR COMPOSTING FACILITIES IN ALBERTA



2.4 Summary of Existing Composting Facilities

A listing of composting facilities with active approvals (including those operations under notification and registration) was obtained from Alberta Environment's approval database. This list, and details on technology type and facility capacities, was supplemented with the Project Team's and the L&YW Diversion Technical Committee's personal knowledge of facilities, and the results from a survey of selected facility managers and operators.

The consolidated listing of active facilities is provided in Exhibit 2-8.

EXHIBIT 2-8
ACTIVE COMPOSTING FACILITIES IN ALBERTA

Facility Name	APV ID	Class (old)	Class (new)	Feedstocks	Size Range	Geographic Region
Alberta Beach Compost Facility	80043	Class II	Class III	L&YW	Small	North Saskatchewan
Banff WWTP Biosolids Compost Facility	382	Class I	Class II	Biosolids	Very Large	North Saskatchewan
Camrose Compost Facility	75494	Class II	Class II	L&YW	Small	North Saskatchewan
Castle Junction Compost Curing Facility	N/A	Class I	Class II	Biosolids	Large	North Saskatchewan
Chipman Compost Facility	76171	Class II	Class III	L&YW	Very Small	North Saskatchewan
Cleanit Greenit Compost Facility	218439	Class I	Class II	L&YW, Biosolids, Food waste	Very Large	North Saskatchewan
Drayton Valley Compost Facility	50188	Class I	Class II	L&YW	Small	North Saskatchewan
Edmonton Biosolids Composting Operation	20440	Class I	Class II	Biosolids	Very Large	North Saskatchewan
Edmonton Co-composting Facility	20440	Class I	Class I	L&YW, Biosolids, MSW	Very Large	North Saskatchewan
Edmonton Valley Zoo	N/A	N/A	Class III	Manure	Small	North Saskatchewan
Edmonton YW Composting Operation	20440	Class I	Class II	L&YW	Small	North Saskatchewan
Flagstaff Compost Facility	75741	Class II	Class III	L&YW	Small	North Saskatchewan
Fort Saskatchewan	N/A	Class II	Class II	L&YW	Small	North Saskatchewan
Jasper Biosolids Composting Facility	N/A	Class I	Class II	Biosolids	Medium	North Saskatchewan
Jasper SSO Composting Facility	N/A	Class I	Class II	L&YW, Food Waste	Small	North Saskatchewan
Leduc Regional Compost Facility	79090	Class II	Class II	L&YW	Small	North Saskatchewan
Legal Compost Facility	155162	Class II	Class III	L&YW	Very Small	North Saskatchewan
Prins Compost Facility	207829	Class II	Class II	Manure	Medium	North Saskatchewan
Provost Compost Facility	160908	Class II	Class III	L&YW	Very Small	North Saskatchewan
Redwater Compost Facility	50104	Class II	Class III	L&YW	Very Small	North Saskatchewan
Rocky Mountain House Compost Facility	213179	Class II	Class II	L&YW	Small	North Saskatchewan
Roseridge Compost Facility	47061	Class II	Class II	L&YW	Medium	North Saskatchewan
University of Alberta	N/A	N/A	N/A	Manure	Large	North Saskatchewan
Wetaskiwin LF	75486	Class II	Class II	L&YW	Small	North Saskatchewan
Wieting Corral Cleaning Ltd.	160882	Class II	Class III	Manure	Small	North Saskatchewan
Airdrie Compost Facility	76370	Class II	Class III	L&YW	Very Small	South Saskatchewan
City of Lethbridge	N/A	Class II	Class III	L&YW	Small	South Saskatchewan
CR Fruit Compost Facility	250553	Class II	Class II	Manure	Small	South Saskatchewan
Earthworks Environmental	49703	Class II	Class III	L&YW	Very Small	South Saskatchewan
East Calgary Compost Facility	N/A	Class II	Class II	L&YW, Food Waste	Small	South Saskatchewan
Foothills Regional Compost Facility	47447	Class I	Class II	L&YW	Medium	South Saskatchewan
Francis Cooke Compost Facility	49173	Class II	Class III	L&YW	Very Small	South Saskatchewan
International Compost Ltd.	48601	Class I	Class II	Manure	Very Large	South Saskatchewan
Lethbridge Regional Waste Mgt. Servcies Commission	N/A	Class II	Class III	L&YW	Small	South Saskatchewan
Lethbridge Research Station	N/A	N/A	N/A	Manure	Large	South Saskatchewan
Medicine Hat Biosolids Compost Facility	78193	Class I	Class II	Biosolids	Large	South Saskatchewan
Medicine Hat L&YW Compost Facility	78193	Class I	Class II	L&YW	Medium	South Saskatchewan
Okotoks WWTP Biosolids Compost Facility	1028	Class I	Class II	Biosolids	Very Large	South Saskatchewan
Roseburn Ranches	70211	Class I	Class I	L&YW, Biosolids, Manure, Food Waste	Very Large	South Saskatchewan
Shepard Compost Facility	19090	Class II	Class II	L&YW, Manure	Small	South Saskatchewan
Spyhill Compost Facility	19101	Class II	Class II	L&YW	Small	South Saskatchewan
Swalwell Compost Facility	193149	Class II	Class II	Manure	Medium	South Saskatchewan
Taber Compost Facility	137511	Class II	Class II	L&YW	Small	South Saskatchewan
Theissen's Feedlot	N/A	N/A	N/A	Manure	Large	South Saskatchewan
Thorlakson Feedyards	N/A	N/A	N/A	Manure	Large	South Saskatchewan
University of Calgary	NA	N/A	Class II	Manure	Small	South Saskatchewan
Alix Compost Facility	76173	Class II	Class III	L&YW	Small	Red Deer
Blackfalds Compost Facility	75493	Class II	Class III	L&YW	Small	Red Deer
Bowden Compost Facility	216619	Class II	Class III	L&YW	Very Small	Red Deer
Bowden Institute Compost Facility	70372	Class I	Class II	L&YW, Food Waste, Biosolids	Large	Red Deer
Drumheller LF	47449	Class II	Class II	L&YW	Small	Red Deer
Eckville Compost Facility	75495	Class II	Class III	L&YW	Small	Red Deer
Lacombe Compost Site	208317	Class II	Class III	L&YW	Very Small	Red Deer
Olds College Compost Facility	150154	Class I	Class II	L&YW, Food waste, Manure	Medium	Red Deer
Ponoka Compost Facility	75747	Class II	Class III	L&YW	Small	Red Deer
Red Deer Compost Facility	75749	Class II	Class II	L&YW	Medium	Red Deer
Rimbey Compost Facility	75566	Class II	Class III	L&YW	Small	Red Deer
Stettler Compost Facility	75685	Class II	Class III	L&YW	Small	Red Deer
Cold Lake Compost Facility	240095	Class I	Class II	L&YW, Food Waste	Medium	Lower Athasbasca
Fort McMurray LF	N/A	Class II	Class II	L&YW	Medium	Lower Athasbasca
Fort McMurray WWTP	N/A	Class I	Class I	Biosolids	Very Large	Lower Athasbasca
Edson Compost Facility	221204	Class II	Class III	L&YW	Small	Upper Athabasca
Slave Lake Lesser Slave Regional Landfill	72856	Class II	Class III	L&YW	Very Small	Upper Athabasca
High Level Landfill Compost Facility	73493	Class II	Class III	L&YW	Very Small	Lower Peace
Grande Prairie Landfill		Class II	Class II	L&YW	Small	Upper Peace

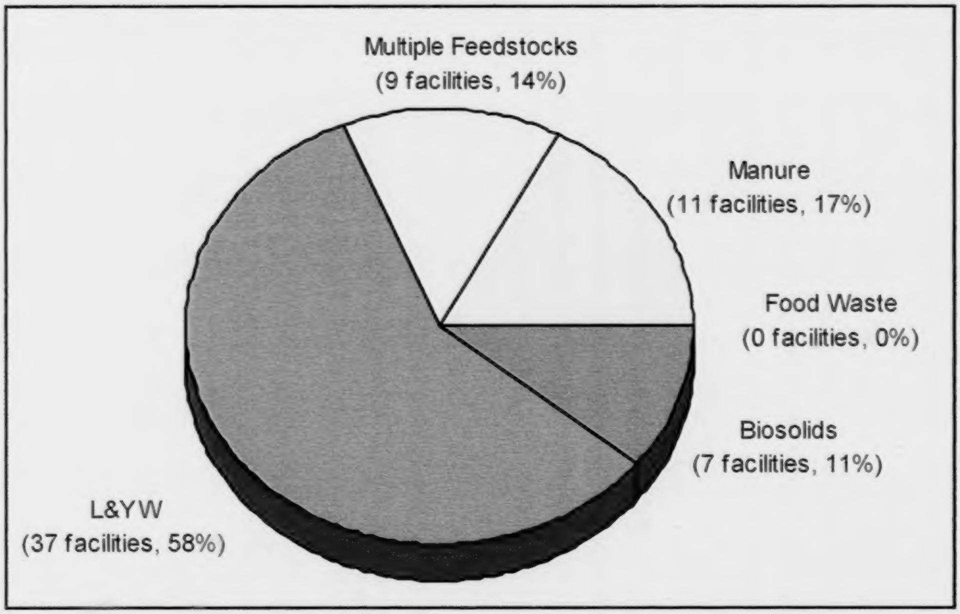
Most of the composting facilities that currently exist in Alberta process L&YW and fall into the Class 2 category. There are a handful of facilities that are categorized as Class 1 facilities as a result of the feedstocks they handle (e.g. biosolids, food waste) rather than size. There are no L&YW processing facilities that fall into the Class 1 category based on size (e.g. > 20,000 tpy).

Under the new facility classification scheme, the majority of the existing facilities (32 of 64) would be classified as Class II facilities, and 23 would be classified as Class III facilities. Only three facilities would be classified as Class I facilities.

In addition to the facilities permitted by Alberta Environment, there are several additional sites that fall outside of Alberta Environment's jurisdiction. These include several large agricultural waste facilities in the Calgary area, and manure composting facilities at the University of Alberta, the University of Calgary, and Agriculture Canada's Lethbridge Research Station.

A summary of the number of existing facilities classified by the type of feedstock(s) they process is provided in Exhibit 2-9.

EXHIBIT 2-9
SUMMARY OF COMPOSTING FACILITIES IN ALBERTA



2.5 Geographical Distribution

The locations of the known composting facilities were mapped relative to the seven geographic regions developed as part of Alberta's Land Use Framework. A map showing the location of facilities is contained in Exhibit 2-10.

Exhibit 2-11 contains a summary of the number of facilities and total processing capacity within each geographic region.

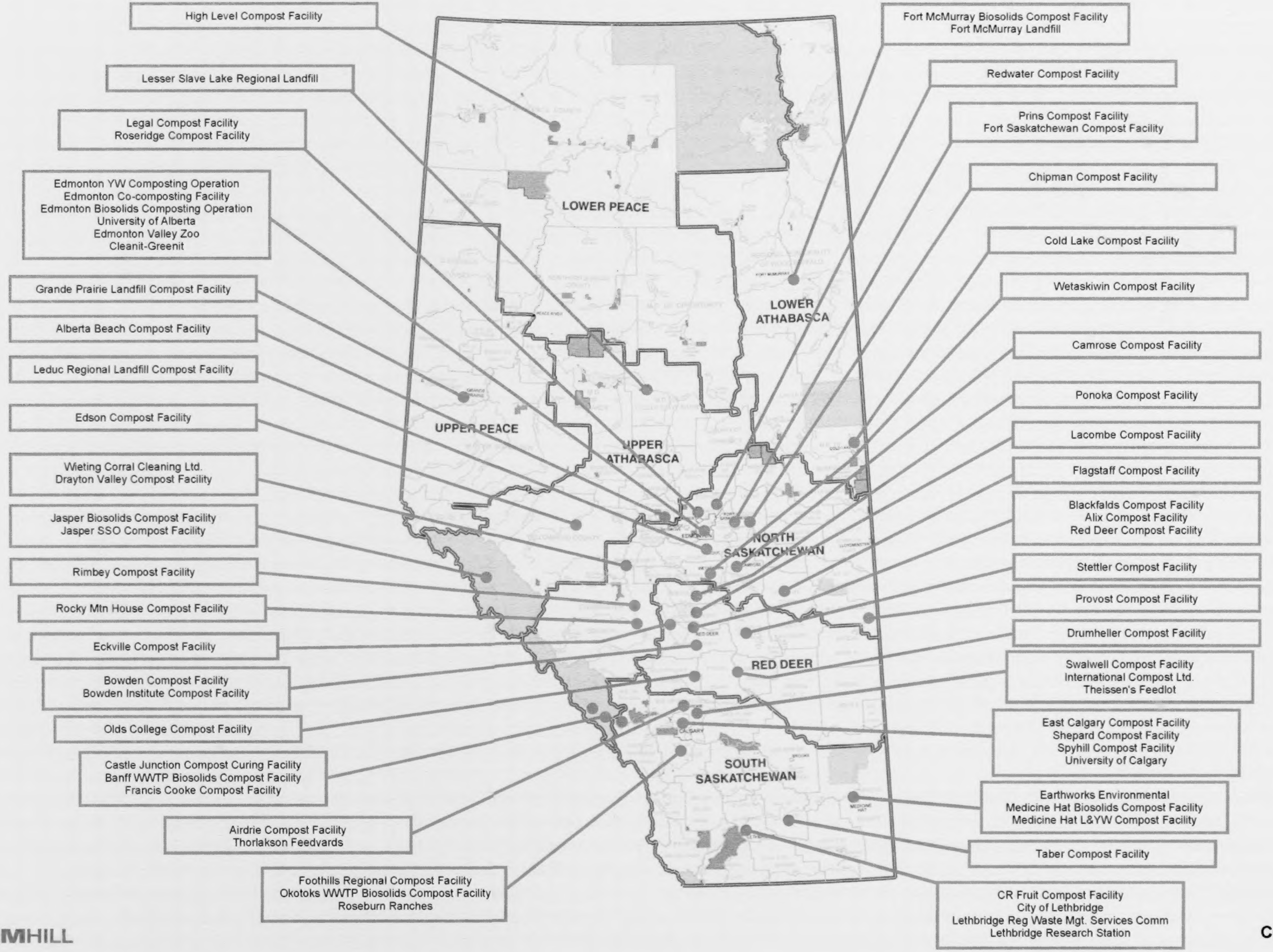

High Level Compost Facility
Lesser Slave Lake Regional Landfill
Legal Compost Facility
Roseridge Compost Facility
Edmonton YW Composting Operation
Edmonton Co-composting Facility
Edmonton Biosolids Composting Operation
University of Alberta
Edmonton Valley Zoo
Cleanit-Greenit
Grande Prairie Landfill Compost Facility
Alberta Beach Compost Facility
Leduc Regional Landfill Compost Facility
Edson Compost Facility
Wieting Corral Cleaning Ltd.
Drayton Valley Compost Facility
Jasper Biosolids Compost Facility
Jasper SSO Compost Facility
Rimbey Compost Facility
Rocky Mtn House Compost Facility
Eckville Compost Facility
Bowden Compost Facility
Bowden Institute Compost Facility
Olds College Compost Facility
Castle Junction Compost Curing Facility
Banff WWTP Biosolids Compost Facility
Francis Cooke Compost Facility
Airdrie Compost Facility
Thorlakson Feedyards
Foothills Regional Compost Facility
Okotoks WWTP Biosolids Compost Facility
Roseburn Ranches
Fort McMurray Biosolids Compost Facility
Fort McMurray Landfill
Redwater Compost Facility
Prins Compost Facility
Fort Saskatchewan Compost Facility
Chipman Compost Facility
Cold Lake Compost Facility
Wetaskiwin Compost Facility
Camrose Compost Facility
Ponoka Compost Facility
Lacombe Compost Facility
Flagstaff Compost Facility
Blackfalds Compost Facility
Alix Compost Facility
Red Deer Compost Facility
Stettler Compost Facility
Provost Compost Facility
Drumheller Compost Facility
Swalwell Compost Facility
International Compost Ltd.
Theissen's Feedlot
East Calgary Compost Facility
Shepard Compost Facility
Spyhill Compost Facility
University of Calgary
Earthworks Environmental
Medicine Hat Biosolids Compost Facility
Medicine Hat L&YW Compost Facility
Taber Compost Facility
CR Fruit Compost Facility
City of Lethbridge
Lethbridge Reg Waste Mgt. Services Comm
Lethbridge Research Station
LOWER PEACE
LOWER ATHABASCA
UPPER PEACE
UPPER ATHABASCA
NORTH SASKATCHEWAN
RED DEER
SOUTH SASKATCHEWAN

Exhibit 2-10
Compost Facility Locations

EXHIBIT 2-11

SUMMARY OF COMPOSTING FACILITIES AND PROCESSING CAPACITY BY GEOGRAPHIC REGION

Region	# Class 1 Facilities	# Class 2 Facilities	Non-EPEA Facilities [1]	Existing Processing Capacity (tpy)
North Saskatchewan	9	14	2	326,370
South Saskatchewan	6	11	4	141,414
Red Deer	2	10		23,340
Lower Athabasca	**2**	**1**		47,250
Upper Athabasca	**0**	**2**		600
Lower Peace	**0**	**1**		55
Upper Peace	**0**	**0**		0
Total	**19**	**39**	**6**	**539,029**

Notes:

1. Includes facilities regulated under AOPA and facilities on federal land.

2.6 L&YW Processing Infrastructure Deficit

Using the estimates of L&YW quantities prepared as part of this study, and the existing diversion estimates contained in Exhibit 2-11, it is possible to identify the approximate deficit in processing capacity in each of the seven geographic regions. This deficit is summarized in Exhibit 2-12.

In calculating this deficit, it has been recognized that the processing capacity of the existing facilities in the province is, for all practical purposes, being fully utilized (i.e. there is no surplus or unused processing capacity at the existing facilities). Increasing the processing capacity of these existing facilities will require an investment in new infrastructure, equipment, or operating procedures.

Processing deficit calculations are also based on 100% of the provincial L&YW quantity estimates (i.e. Exhibit 2-4), and do not factor in participation and capture rates of various types of collection programs (e.g. drop-off depot, curbside collection).

EXHIBIT 2-12

ESTIMATE OF L&YW PROCESSING CAPACITY DEFICIT BY GEOGRAPHIC REGION

Region	L&YW Quantities			Existing Organic Waste Processing Capacity [1]			Estimated Quanitity of L&YW Processed	L&YW Processing Deficit [9]
	Residential	ICI	Total	L&YW Only	Other Feedstocks[2]	Total		
	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)
North Saskatchewan	151,311	40,917	192,228	12,270	314,100	326,370	99,046	~93,200 [3,4]
South Saskatchewan	200,646	49,855	250,501	11,464	129,950	141,414	13,289	~238,000 [5]
Red Deer	15,147	6,826	21,973	8,340	15,000	23,340	13,840 [7]	~8,100 [6]
Lower Athabasca	6,476	2,619	9,095	4,250	43,000	47,250	5,750	~3,350 [8]
Upper Athabasca	7,410	3,815	11,225	600	0	600	600	10,625
Lower Peace	2,617	1,359	3,976	55	0	55	55	3,921
Upper Peace	6,588	3,091	9,679	0	0	0	0	9,679
Total	**390,195**	**108,482**	**498,677**	**36,479**	**502,050**	**536,929**	**132,580**	**~366,875**

Notes:

1. The existing processing capacity is, for all practical purposes, 100% consumed (i.e. existing facilities have no surplus capacity).
2. Includes facilities that process multiple feedstocks, one of which may be L&YW.
3. Assumes 30% of the capacity of the Cleanit-Greenit (6,000 tpy) and Jasper (150 tpy) facilities are consumed by yard waste.
4. Assumes 66% of residential L&YW from the City of Edmonton (80,626 tpy) is being processed through the Co-composter.
5. Assumes 50% of the capacity City of Calgary facilities (1,825 tpy) is consumed by L&YW, and negligible L&YW quantities are processed by Roseburn Ranches.
6. Assumes 50% of the facility capacity in Olds (2,500 tpy) and 30% of the capacity at Bowden Institute (3,000 tpy) is consumed by yard waste.
7. Includes material being processed at the Bowden Institute which has been slated for closure by the Federal Government.
8. Assumes 50% of the facility capacity in Cold Lake (1,500 tpy) is consumed by yard waste.
9. Assumes 100% diversion of available L&YW.

3 L&YW Collection Programs

Leaf and yard wastes in Alberta are generally collected at drop-off depots or through curbside collection programs, or they are hauled directly to processing facilities by L&YW generators.

3.1 Drop-off Depots

Following direct haul of materials by L&YW generators to processing sites, drop-off depots are the most cost-effective collection method available since much of the work is delegated to waste generators. However, due to the lower level of convenience for waste generators, drop-off collection programs rarely collect more than 50% of the available leaf and yard waste; more commonly, diversion rates in the range of 10% to 25% are achieved. Diversion rates through drop-off programs depend upon a number of factors including:

- level of education/awareness programming undertaken in the municipality;
- number and location of the depots (e.g. proximity to generators); and
- physical accessibility if the drop-off site (e.g. layout, driving surfaces).

L&YW drop-off depots range in their level of development and sophistication. At one end of the spectrum are depots that consist of nothing more than an open area with vehicle access, where L&YW are dumped in a single large pile. At the other end of the spectrum are paved areas that contain designated containers and/or bunkers for different materials (e.g. grass and leaves, shrubs and branches, large branches, logs and stumps), and have specific traffic flow patterns. The former are more common at small towns or villages or regional transfer stations while the latter tend to be used at larger sites that experience higher traffic volumes, or at sites that have close neighbours.

Piles and bunkers are both quite common at L&YW drop-off locations in Alberta. In both cases, no special collection truck is required, and quite often dump trucks (which are owned by most municipalities) are used to transfer L&YW from the drop-off site to the processing facility. For larger programs with longer haul distances (e.g. > 50 km round trip), it may be more economical to use walking floor trailers with payload capacities of 20 or more tonnes instead of dump trucks with payloads of 5 to 10 tonnes.

Bunkers generally help to maintain a cleaner looking site and piles, and a suitably constructed bunker serves as a convenient push-wall for front-end or skid-steer loaders used to empty the L&YW depot. Bunkers can be constructed from a number of materials (e.g. wooden timbers, old telephone poles, cast-in-place concrete). However, the use of pre-cast concrete "ecology-blocks" is the most common and often most convenient.

New ecology-blocks are generally available for between $100 and $150 each, and can be placed using skid-steers, front-end loaders or trucks with picker-cranes. A typical drop-off depot with two bunkers, limited earthwork requirements, and no concrete base pad can be constructed from 45 to 50 blocks for a cost of approximately $7,500. This cost will increase as the distance from the ecology-block supplier (and thus delivery costs) increases, and if there is a substantial amount of earthwork (e.g. leveling and compaction) required. Costs can be reduced by using off-spec ecology blocks, or blocks made from leftover concrete from other pre-cast jobs (if available, these blocks can be purchased for as little as $50 each).

Grass Clippings, Leaves
and Garden Wastes

The use of low-sided roll-off containers at drop-off depots is less common, but equally functional. The containers eliminate the handling associated with loading materials into a dump truck or other transfer vehicle. Containers also provide better containment of liquid run-off from the L&YW, which in turn helps control odours associated with standing water and potential impacts on groundwater quality. However, containers do require the purchase of a specialized truck, or the contracting out of the transfer service. Also, stairways/walkways or retaining walls are often required so that site users can safely lift and deposit materials into the container.

The cost of a 30 yd^3 open-topped roll-off container is in the range of $7,500. Depending on whether it is made from wood or steel, stairs and walkways could cost between $500 and $2,500 per bin. If a retaining walls system is constructed, the cost of the drop-off depot can easily exceed $25,000.

Rather than providing one or two larger drop-off locations, some municipalities provide several "neighbourhood drop-off sites" as a means of boosting convenience and participation. These neighbourhood sites typically consist of some form of larger waste container, such as a commercial front-end bin, oversized wheeled carts, or a Haul-All semi-automated container. Since site preparation requirements are generally minimal, costs are generally limited to the cost of the container. This can range from a few hundred dollars for wheeled carts, to $7000 for Haul-All's semi-automated bin. Depending upon the type of container, specialized collection trucks may have to be purchased, or the service contracted out.

Regardless of the style of depot constructed, drop-off sites should be closely managed to prevent nuisance conditions from developing, particularly if they are located in or close to residential areas. At a minimum, the accumulated L&YW materials should be emptied on a weekly basis, and more frequently during periods of wet weather. Good roads and working surfaces should be provided to ensure that the site is accessible during wet weather as well. Clearly worded and visible signs should be set up to provide directions to site users.

Drop-off sites can be supervised or unsupervised. An unsupervised site will be less costly to operate, and there are several examples of successful sites in Alberta (i.e. St. Albert, Okotoks, High River). However there is an increased potential for residents to drop off materials that are not accepted, or for vandalism. Unsupervised drop-off sites intended for use only by residents can also quickly be filled up by landscapers or other prohibited businesses that choose ignore site usage rules.

3.2 Curbside Collection Programs

Curbside collection of L&YW can significantly increase diversion rates by driving up program participation. In established programs, consistent participation rates of 80 to 90% are not uncommon.

Early adopters of curbside L&YW collection programs allowed residents to set out materials in regular plastic garbage bags. However, experience soon showed that this approach lead to higher contamination levels in the L&YW, resulting in part from generators "hiding" unacceptable wastes in the bags to avoid disposal charges or garbage bag limits. The industry soon switched to using clear garbage bags (and to a lesser extent translucent green bags), which allow the bag's contents to be inspected at the curb, and left behind if contamination levels are unacceptable.

Plastic bag-based programs provide a convenient option for both residents and municipalities since the bags are readily available at retail stores, and they require no special collection vehicles. Often leaf and yard wastes can be collected using the trucks that are used for regular garbage collection. This allows a municipality to integrate leaf and yard waste into existing collection programs without having to change or purchase additional collection trucks. One downside to bag-based programs is that bags of wet green grass can be heavier than bags of garbage, and collection vehicle workers are subjected to a higher risk of back strains and injuries.

Another downside to plastic bag-based programs is the high cost of opening bags and separating the plastic from the L&YW prior to composting. If L&YW volumes are large enough (e.g. > 100 tonnes per day), the investment in dedicated mechanical bag-opening equipment may be warranted. For moderately sized programs that have a dedicated trommel screens at their composting operation, it may be feasible to retrofit the trommel to act as a bag opener. At smaller sites, bag opening is best done by a crew of labourers equipped with carpet knives. Regardless of the means used to open bags, there is a high likelihood that not all of the plastic will be removed, and that physical contamination of the finished compost product will result from small pieces of film plastic left behind.

As an alternative to plastic bags, paper L&YW bags are available for roughly the same cost as a large clear plastic bag (e.g. ¢50/bag). These paper bags have the benefit that they can be incorporated into the composting process without affecting product quality.

A new generation of biodegradable plastic bags that break down during the composting process has become available over the past two to three years. While the bags may not fully degrade, they do help to physical contamination issues, and are becoming more widely used in source-separated organic waste (SSO) collection programs in Central Canada.

Collection of L&YW, garbage and recyclables using wheeled carts and automated or semi-automated trucks has been done in Central and Eastern Canada for many years, and is gaining in popularity in Western Canada. Carts-based collection programs eliminate the need for, and the problems caused by plastic bags. Carts are available in a number of sizes ranging from 50 L (13 gallons) to 360 L (95 gallon). This allows municipalities to choose a cart that matches the program's collection frequency, waste generation rates in a community, and the type of material being handled (e.g., yard waste, food waste, or both). Popular cart sizes used in North America programs are 120 L, 245 L and 360 L. Choosing the appropriate size of cart is often based on waste statistics, collection program pilot testing and resident surveys. Guidance from the experiences of similar communities is also valuable.

Curbside collection programs, whether they are based on bags or carts, are not well suited to collection of bulky or heavy yard wastes such as tree limbs, logs, stumps, or sod. Often these materials are banned from curbside collection programs, or strict limitations are put in place (e.g. maximum diameter and length of tree limbs, weights of bags or carts, requiring limbs to be tied in bundles). When bans or limits for bulky and heavy materials are put in place, at least one drop-off location should be established where residents can bring these materials.

Although curbside programs can increase diversion rates, it comes at a substantially higher cost than maintaining and operating a network of drop-off sites. Prices for collection are typically in the $4 to $6 per household per month range, although this does vary depending on the frequency of collection (weekly versus biweekly), the number of households, and the distance to/from processing facilities. To provide a balance between higher diversion rates and higher costs, some communities opt to provide curbside collection on periodic basis (i.e. spring and/or fall) rather than throughout the spring, summer and fall. Another approach is to provide curbside collection on "subscription" basis, where households voluntarily sign up for collection service and pay an additional monthly or annual cost. Anecdotal information indicates that the collection costs of spring/fall and subscription programs are similar to full season programs.

3.3 Institutional and Commercial L&YW

L&YW from institutional and commercial sources and from multi-family dwellings (e.g. apartment and condominium complexes) is generally collected by staff or contractors that maintain the facility grounds. Although some municipalities will accept and handle this material at residential drop-off depots, it is more common that it is delivered directly to a disposal or processing facility.

Many municipalities specifically prohibit the use of residential drop-off depots by institutional and commercial customers. These prohibitions are often the result of equity issues and program funding sources (e.g. program being funded from residential tax base). Prohibitions may also be a result of depot size and hauling logistics; the depot may not be large enough to accommodate the volumes of material from commercial sources, or the hauling requirements may outstrip municipal resources.

3.4 Summary

A tabular summary of the various L&YW collection options is provided in Exhibit 3-1.

EXHIBIT 3-1

COMPARISON OF COLLECTION OPTIONS

Program Type	Typical Participation Rate	Odour & Nuisance Potential	Capital Cost	Operating Cost	Small	Medium	Large
Drop-off Depot:							
Pile	10 to 25%	High	<$2,000	Low	✓	✓	
Bunker		Low – Moderate	~$7,500	Low	✓	✓	✓
Roll-off Container		Low - Moderate	~$10,000	Low - Moderate	✓	✓	
Neighbourhood Bins		Low - Moderate	$500 to $7,500	Moderate to High	✓	✓	
Curbside	<80%	Low	Varies[1]	Moderate to High		✓	✓

Notes:

1. Magnitude of capital cost for curbside collection is dependant on whether the service is outsourced.

4 Composting Methods

Composting of organic wastes can be carried out at various levels from simple backyard operations to large central facilities. The composting principles are the same at each level even though differences occur in the composting rates, control methods, and the composting vessels. Composting applications are generally divided into three levels:

- home or backyard composting;
- mid-scale or on-site composting; and
- centralized composting.

Home composting is a common component of municipal waste reduction strategies across North America. By encouraging and assisting residents to compost their organic wastes at home, municipalities can divert organic waste from landfills, and reduce overall waste collection costs. As a result of the popularity of these programs, a wide variety of backyard compost containers are available on the market. Most municipalities also provide plans for home-made compost bins.

Mid-scale composting typically refers to the composting of moderate quantities (i.e. less than one tonne per day) of organic waste by large waste generators on their own site. Examples of on-site composting applications are at restaurants, cafeterias, hospitals, apartment buildings, airports, shopping malls, office buildings, and schools. The benefit of on-site composting is the avoidance of the costs incurred to transport organic wastes off-site for disposal or processing.

Centralized composting applications involve the collection of organic wastes from several different generators, and processing at a single facility. These facilities are generally large, with capacities ranging from a few tonnes per day up to several hundreds of tonnes per day. Centralized composting has been practiced in Europe and North America for several years. As a result, a wide range of technologies and techniques have been developed, ranging from simple and inexpensive, to complex and costly. Generally, centralized systems fall into one of the following categories:

- windrows and static piles;
- actively aerated static piles; and
- enclosed composting technologies.

This section provides a brief overview of the main centralized composting techniques and technologies currently available. A summary of the advantages and disadvantages of the various composting technology options is provided in Exhibit 4-1.

4.1 Static Pile Composting

This method of composting is amongst the simplest and least costly options, and is often used by smaller municipalities which are composting for the first time, or when an abundance of woody materials, space, and time are available. The static pile method of composting involves forming the collected organics materials into large windrows or piles which are then allowed to decompose over an extended period (i.e. 2 to 3 years) with little or no mixing. Static pile composting typically takes much longer to complete than other methods due to the low rate of

aeration and agitation. This longer residence time also means that a greater amount of space is required relative to other methods which process materials more quickly.

The piles are normally shaped using front-end loaders, skid-steers, farm tractors or stacking conveyors. It is good practice to separate piles with roads or aisles to allow for equipment access and fire suppression in the event of spontaneous ignition.

The windrows or piles are constructed with the expectation that they will passively aerate themselves. Therefore it is very important that materials initially be mixed with enough amendment to provide sufficient porosity for aeration. Despite this, the process is often largely anaerobic with the exception of the pile exterior.

Since anaerobic conditions are so prevalent, odours generate quickly and can affect the surrounding community. Release of odours often takes place when the piles are mixed or moved. The higher potential for odours increased the need for buffer zones between the compost site and adjacent properties, which in turn increases land requirements.

Occasional remixing and reformation of the static pile is helpful in re-establishing porosity which is lost over time as the materials degrade. Without periodic mixing, there will be areas in the pile which do not attain the required composting temperatures and thus a proportion of the material will not be adequately composted. The outer layer may not undergo composting at all.

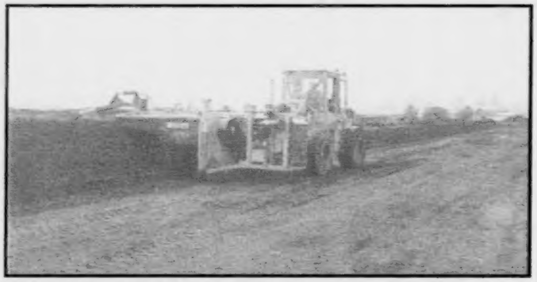
A properly managed static windrow can be effective at minimizing runoff issues. The larger piles typically to this approach have less exposed surface area which provides some protection from infiltration of rain and snow melt.

Historically, static pile composting has been used to process yard waste and bark mixtures, biosolids and sawdust mixtures. However, the system is generally not suited for use in urban areas where odours can be constantly emitted from the pile and agitation of older material releases odours as the aerobic process is re-started. Static pile composting is not commonly used in Alberta; the City of Fort Saskatchewan is one of only a few such operations in the province.

4.2 Windrow Composting

Windrow composting is the most common composting method used in Alberta. Like the static pile method, it requires little in the way of infrastructure and has relatively low installation and operating costs compared to other composting methods.

What defines turned windrow composting is that the materials being processed are formed into long low piles (a.k.a. windrows) that are typically 3 to 9 feet high and 10 to 20 feet wide. The windrows are regularly and completely moved or "turned" to re-establish porosity in the material, to chop it up, and to blend it.



Turning is done using mobile equipment such as a front-end loader, a skid steer, or a farm tractor and manure spreader. Several styles and sizes of specially designed windrow "turners" have also been developed specifically for this task.

The windrows are usually built on a firm working surface, or "pad" which is constructed to support the weight of delivery vehicles and turning equipment without rutting, and sloped to drain run-off. The most common types of composting pad surfaces are concrete, asphalt, cement treated base, and compacted gravel.

Although the turning process introduces oxygen into the windrow, this is quickly consumed. In some cases, enough oxygen can be consumed for anaerobic conditions to become established in as little as 30 minutes. Thus aeration of the windrows is largely passive and depends on the porosity of the pile. The size of the windrow is a balance between keeping it small enough to maintain aerobic conditions through passive aeration and yet large enough to hold heat and achieve temperatures high enough to evaporate moisture and kill pathogens.

With each turn of the pile, trapped heat, water vapor, and gases are released into the atmosphere, and therefore this method of composting has the potential to affect adjacent neighbouring properties. Windrow turning activities should always be scheduled to have the least impact on neighbours.

A properly managed turned windrow composting facility can be inexpensive but it requires land and buffer areas to minimize odour impacts. The solution to odour prevention and control is to ensure that experienced facility design and management expertise are used, and that on-site staff are well trained in the principles of composting and troubleshooting solutions when problems arise. Most turned windrows are situated in non-urban settings surrounded by a large buffer zones. Often, they are placed at the landfill which offers ample land, berms, and buffer areas.

Processing times for L&YW using windrow composting can be as low as three to four months if the site is aggressively managed, but six to twelve months is more common in Alberta due to growing seasons and winter conditions.

Because processing times are lower, the same amount of material can be processed on a smaller footprint using windrow composting than static piles. The amount of space required for windrow composting is also influenced by the type of equipment used to turn the windrows, which determines the windrow size and spacing. Generally, sites that use straddle-type windrow turners can manage more material in the same amount of space than a site that uses front-end loaders or manure spreaders.

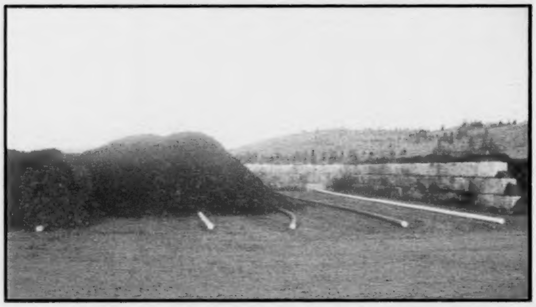
Windrow composting is almost always done outdoors where it is exposed to precipitation. This can lead to runoff management problems. Any runoff created must be collected and treated, or added to a batch of incoming feedstock to increase its moisture content. To avoid problems with runoff, piles can be placed under a roof, although this adds to the capital costs of the facility, and can make it more difficult to move material around the facility.

There are many examples of L&YW windrow composting operations in Alberta including those at the Leduc and District Regional Landfill, the East Calgary Landfill, the Foothills Landfill near Okotoks, and the City of Medicine Hat's composting facility.

4.3 Aerated Static Pile Composting

Although this method of composting was developed in the early 1970's, it has only gained popularity in the past decade. Aerated static pile composting offers less exposed pile surface, less agitation, and, if designed to operate using negative aeration, it allows for a higher level of odour control than static pile and windrow composting. Aerated static pile composting systems have been used successfully for leaf and yard waste, food waste, animal mortalities, biosolids, and industrial composting.

In this method of composting, fresh air is either blown into the composting pile (positive aeration) or drawn out of the pile (negative aeration) with fans. This forced circulation of air through the compost piles provides the needed oxygen for the composting microbes, removes moisture, and prevents excessive heat build-up in the pile. Removing excess heat and water vapour cools the pile to maintain optimum temperatures for microbial activity. A controlled air supply enables construction of large piles, which decreases the need for land as compost stays in one place and does not need to be moved around the site.



Organic materials are typically piled to depths of 2 to 4.5 m, depending upon the feedstock characteristics. In more extensively engineered systems, pile heights of 8 to 10 m are possible.

The air is distributed through the pile via a diffuser system. Most often this consists of a network of solid and perforated pipes in the base of the pile. The perforated sections of the pipe are embedded in a porous base of wood chips or straw. The perforated pipes and the porous base layer are constructed such that they are 2 to 4 m from the edges of the pile. This is to prevent air "short circuiting" out the ends and sides of the pile rather than passing through the material of the pile.

In larger facilities, below-grade air systems (e.g. covered trenches, pipe and spigot arrangements) are often used instead of above ground perforated pipes. These systems are more costly to construct, but have several operational advantages including quicker pile construction and tear-down, less wasted pipe (above ground pipes are often damaged and need replacement), and more efficient air delivery.

There is no standard width or length for aerated static piles; it is often dependent of site specific situations and land availability.

Two forms of piles are common: single and extended piles. Single piles are normally used in smaller applications where material is composted in batches. Materials received within a short period of time (e.g. within 3 to 5 days) are used to form the pile, which is subsequently aerated by a single fan. Since the material is approximately the same age and has the same demand for air throughout, a simple aeration control system can be used.

Extended piles are used when materials are generated daily and each day's intake is sufficient for a single cell. The cells are built against each other as the material arrives. This results in better use of the pad area. Cell widths are made equal to the pile height and each cell has its own pipe and fan, with the spacing between pipes equal to the pile height. Each fan is controlled by an individual timer or temperature probe for that cell.

As the pile is not turned frequently, particular attention must be given to the blending of the material with structural amendments to maintain porosity throughout the composting period. It is important to achieve a homogeneous mixture and not compact the material with machinery while constructing the pile, so that air distribution is even and no anaerobic areas develop causing sections of uncomposted material.

If positive airflow is used, the piles are normally covered with an outer layer of finished compost which helps to treat odours. When negative aeration is used, the concentration of odourous compounds in the air removed from the pile will be much higher and some form of treatment is needed. The most common practice is to exhaust the air from the pile through a biofilter.

Air flow can be continuous or intermittent. Continuous operation allows for lower air flow rates but excessive cooling may result if the system is not carefully design and managed. Over cooling piles can prevent the temperatures needed for pathogen destruction from being reached, and can lengthen the time required to stabilize materials.

Intermittent fan operation is more common. Aeration fans are typically controlled by a timer, or by a system that measures temperatures in the piles and turns the fans on and off much like a home thermostat.

Fans are usually of the centrifugal axial blade type. The size of the fan depends on a number of factors including the type and porosity of material in the pile, the size of the pile, and air flow characteristics of the air distribution system. Sizing and selection of the fan is normally done by an experienced designer

When the composting process nears the third or fourth week, the piles are broken up for the first time since their construction. The materials are then further composted in aerated static piles, or possibly using the windrow method. Finished compost from L&YW can be produced using this technology in as little as 10 to 12 weeks during the warmer months of the year.

Advantages of aerated static pile (ASP) composting compared to windrow composting include the management of odorous materials in an undisturbed mass, until such time as they have stabilized. This is one reason that it has been popular in the processing of biosolids. The infrastructure necessary to provide forced aeration normally requires higher capital costs, although staffing and material handling needs are lower as the compost piles do not need turning. There are some low-cost portable, relocatable, and reusable pipe systems that help reduce the capital cost difference.

Due to the pile sizes and configurations, lack of aisles between adjacent piles, and quicker processing times, land requirements for aerated static pile composting is normally less than for windrow systems.

In Alberta, the aerated static pile method has been used by the City of Edmonton and the Municipality of Jasper to compost biosolids, but there are no facilities presently using this method to process L&YW. One very large facility exists in the Vancouver area that uses aerated static piles to process L&YW, and several facilities exist in California where use of this method is driven by stringent air quality regulations.

4.4 Passively Aerated Windrow Composting

This method of composting is a hybrid of the static pile and aerated static pile methods. The mixture of materials to be composted is placed in long, low windrows which are constructed over a base network of perforated open-ended pipes. The open air pipes allow air to naturally diffuse through the windrow without the use of aeration fans.

Perforated HDPE or PVC pipe (4" or 6" diameter) is used when constructing passively aerated windrows. If perforated pipe is unavailable, standard sewer pipe can be used. In this case, holes would be drilled in the pipes manually. A hole pattern of two rows of ½"diameter holes spaced 12 " along the rows. The rows are at a 60 degree angle and may face up or down.

The pipes are spaced 1 to 2 feet apart along the length of the windrow. To further encourage airflow, the windrow can be constructed on a 15 to 20cm high and 3m wide bed of finished compost, straw or peat moss which offers insulation and leachate absorption. The pipes are arranged on top of the bed and a windrow is constructed on top of this arrangement.

A 15cm layer of finished compost is normally placed overtop of the completed windrow to discourage insects and help with the retention of moisture. The outer layer also helps to control odours.

The increased aeration should theoretically allow for quicker processing times relative to a standard static pile approach, however there is limited experience to confirm this. Processing times for L&YW of between one and two years are expected given Alberta's climate.

As the material will not be turned (or turned infrequently) particular attention must be given to the size, structure, moisture and porosity of the material when constructing the windrow so as to maintain adequate aeration throughout the process. Amendments which are commonly used to achieve good structure, are straw and wood chips.

This approach to composting is not commonly used in Alberta although research into its use was been conducted at the Edmonton Waste Management Centre of Excellence in the mid 2000's. The City of Saskatoon currently uses this approach at its L&YW composting sites.

4.5 Turned Mass Bed Composting

Mass bed composting is a continuous flow system and is an improvement upon the traditional windrow method. This approach relies on a specialized windrow turner originally designed by SCAT Engineering (now sold by Vermeer), and the use of windrows that are normally 20 m wide or more.

The original turners designed by SCAT Engineering were, and still are, used for processing individual windrows. They use an inclined conveyor to turn the compost, rather than the rotating drum used by most other windrow turners. As the turner travels down the length of a windrow, the inclined conveyor moves through the material, lifts it up, and throws it backwards off the top of the conveyor.

The original turner design was subsequently modified, and a horizontal cross conveyor was added behind the incline conveyor. As the modified unit travels down the length of the windrow, the material is still lifted up and thrown backwards by the incline conveyor. But rather than falling back on the pile directly behind the turner, the horizontal conveyor catches the material and throws it to the side of the turner opposite the inclined conveyor.

The side throwing action of the modified turner allows it to work sequentially from one side of the mass bed to the other. Each time the turner passes through the bed, it picks up the material to its right and throws it to the left, and in the process creates a new drive aisle to the right. The unit then back up, moves to the right and repeats the process down the newly created aisle. Once the mass bed has been completely turned, it will have been physically relocated 3 to 4 m to the left.

The mass bed composting method can be further improved by combining it with an infloor aeration system. The processing time for this combination of technologies can be much quicker, and with less agitation (and potential odour release) than traditional windrow composting. A processing time of between 6 and 10 weeks could be achieved with L&YW feedstocks.

The primary benefit of the mass bed approach is that it allows for a much larger amount of material to be processed in a smaller footprint relative to windrow composting using a straddle turner or front end loader. And even though the cost of the turning equipment is 50% to 100% higher than large straddle-type turners, the resulting reduction in overall site development costs (resulting from smaller footprint) can make this approach very cost-effective.

The downside to using mass beds is that there is a greater potential for reduced oxygen levels in the piles which can lead to nuisance odours. This drives the need for more frequent turning and higher management, and thus higher operational costs.

The unaerated mass bed approach is currently being used by the City of Edmonton to cure mixed solid waste compost produced at it's co-composting facility, and it's use has allowed the City of make better use of its available curing pad. Two large composting facilities in the Seattle area use aerated mass beds to process L&YW.

4.6 Enclosed Composting

While outdoor composting is a well-established composting technique for managing leaf and yard waste and small amounts of source separated food waste, it is not typically an appropriate technique for managing large volumes of food waste, biosolids, or manures. Some types of enclosed systems are generally more appropriate for large quantities of these feedstocks.

Enclosed composting systems include those which are situated inside of buildings, or where the organic materials are sealed inside some type of vessel or chamber in which the environment is closely controlled. These latter systems, commonly called "in-vessel" systems, may be fixed, portable, and even non-rigid (e.g. Ag-bag or Gore systems).

While feedstock characteristics are a factor, the other primary reasons for locating composting processes within buildings or other enclosures are to improve community acceptance and to protect the process from adverse weather conditions.

A discussion of common enclosed composting approaches is provided in the following sections for completeness. However, these methods are not typically used for processing of L&YW feedstocks given their high capital cost relative to other proven composting methods.

4.6.1 Enclosed Aerated Static Pile Composting

Enclosed aerated static pile composting is simply a variation of the outdoor technology. The process is identical but it includes walls and a ceiling. Typically, the enclosure is expected to have occupants for operating the material handling machinery. Enclosed aerated static pile systems can take the form of tunnels, enclosed bays, bunkers, or large windrows. Most typically, the piles are trapezoidal blocks with push walls.

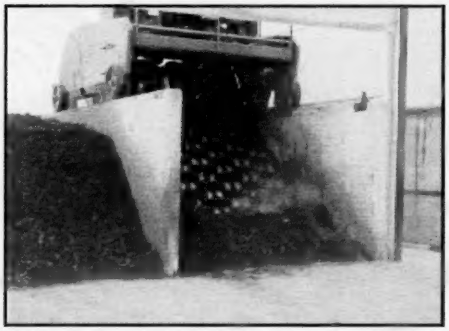
The interior environment and materials used to construct the buildings and enclosures are critically important for sustaining safety and building integrity. Some enclosed facilities have proved to be inadequate with regard to corrosion protection, interior visibility, and indoor air quality. These problems are all related to low air exchange rates for the building interior. The composting process releases large amounts of heat, dust, and water vapour. Under these conditions the building interior will be a rain forest-like environment with interior fog obscuring visibility and condensation dripping off the ceiling interior. These operating conditions are a particular concern for composting facilities in locations where winters are very cold.

Although costs vary among different technologies, enclosed aerated static pile systems are generally less costly than enclosed channel and in-vessel systems.

Examples of enclosed aerated static pile systems in Alberta include the Town of Banff and the Municipality of Wood Buffalo biosolids composting facilities, both of which use tunnels.

4.6.2 Enclosed Channel Composting

Enclosed channel systems are essentially turned windrow piles which are placed inside of buildings. The windrow is situated between two long, parallel walls, usually constructed of concrete. These walls are commonly about 2-3 m high and 6 m wide, (similar in size to most turned windrows). Unlike outdoor turned windows, which form a natural triangular cross-section, enclosed windrows fill the space between the walls.



The raw materials are placed at one end of the channel and are moved down the length of the channel over a period of several days. The material is mechanically 'turned' by a machine that rides along the tops of the walls. Usually, aeration of the material is supplemented by a forced aeration system in the floor of the channel, not unlike that used with some static pile systems. The enclosed system also features a leachate drain collection system built into the floor.

As the turning mechanism makes repeated passes down the channel over time, it gradually moves the mass of material from one end of the channel to the other. The system is designed so that the primary composting process is largely completed by the time that the waste is discharged from the end of the channel. At the end of the processing period, the treated material is typically placed in outdoor windrows or aerated static piles to complete the composting process.

Like other composting approaches the organic waste can be only added to the system once and, consequently, must be in a perfectly-proportioned blend with each application. This requires skilled Operators to work with different loads and types of wastes to ensure the proper blend is achieved.

Channel composting systems have been used by communities to process a wide range of materials. A channel composting facility was installed at the University of Alberta's farm to manage dairy and swine manures.

Although costs vary among different technologies, enclosed channel systems are generally less costly than similarly sized in-vessel systems. Since most of the technology associated with the turning system is suspended over the biomass, servicing and repair of equipment tends to be straightforward.

4.7 In-Vessel Composting

In-vessel composting systems tend to be one of the most capital-intensive of the composting approaches available. The big advantage of these systems is that they take up less space, can be automated, and may be viable where others are not. What differentiates this system from the other aerobic composting system is that the composting process itself is conducted inside some type of sealed container, chamber or vessel, which enables the environment to be highly controlled, with access restricted. Each unit is equipped with forced aeration and mechanical mixing devices and equipment used to feed raw waste into the vessel and remove compost from it. The units include some type of monitoring system for at least temperature and oxygen content within the vessel.

Some in-vessel technologies are designed to have a continual flow of waste through the system, while others process one complete batch of compost at a time, and then are fully emptied before receiving a fresh batch.

One family of in-vessel composting systems uses permanently fixed chambers inside buildings in various sizes, shapes, and design. Because of the enclosed fixed nature of the units, very little modification to the design or expansion of the system can be made once they are constructed. A

second family of in-vessel systems, (commonly referred to as 'container' systems) uses a number of modular composting vessels which are portable and may be moved around the facility. One style of vessel resembles rectangular roll-off waste containers. Other variations of in-vessel systems used vertical silo-styled containers or horizontal rotating drums.

Regardless of the shape, all in-vessel batch composting systems operate in a similar mode. Raw material enters one end of the vessel or container and then the container is sealed. Air is circulated through the vessel by fans to optimize the composting process. The sealed vessel enables the materials to reach the required temperatures to accelerate the rate of composting and destruction of pathogens and weeds. The retention time can be as little as three days. At the end of the primary composting process, the container is disconnected from the air and monitoring systems, emptied, and made available for another cycle. One advantage of in-vessel composting is that all operations are totally enclosed, limiting contact with the organic material, and thus, minimizing occupational health and safety concerns.

As with the enclosed channel system, the material removed at the end of the primary process requires further stabilization and maturation before it can be land applied. Often, this is curing is done outdoors in a windrow system. The curing time can take several months, depending on the material, the level of management, and external conditions.

Odours are more easily managed with in-vessel systems, since all operations are sealed within the vessel, and exhaust air can be collected and passed through a biofilter. In-vessel systems are designed to create ideal composting conditions within the vessel at all times and, therefore, are able to process compost in the shortest amount of time possible. As a consequence, these types of facilities tend to consume the least amount of land of all composting technologies. Given their technology-dependent designs, as a group they also tend to be the most expensive approaches to centralized composting.

In-vessel composting is used by the City of Edmonton to process biosolids and mixed municipal solid wastes, and by the Town of Okotoks to process biosolids.

4.8 Technology Suitability to L&YW

The process of identifying the appropriate composting technology for a particular L&YW processing site should consider a number of criteria, including:

- The quantity of feedstock to be processed;
- Availability of land;
- Proximity of the processing site to neighbours, and the nature of adjacent land uses;
- Temperatures and precipitation during both the summer and winter months;
- Success of the technology in processing similar feedstocks;
- Stormwater management requirements, and process water needs;

- Maintenance requirements of systems and equipment, and availability of parts and service providers;
- Manpower requirements to operation the facility and degree of skill needed;
- Capital and operating costs.

A comparative summary of the various composting methods is provided in Exhibit 4-2. This summary also identifies the applicability of the various methods to small, medium, and large scale L&YW processing operations.

EXHIBIT 4-1
COMPOSTING TECHNOLOGY – ADVANTAGES AND DISADVANTAGES

Technology	Advantages	Disadvantages
Static Pile	• Low capital and operating costs • Piles do not require frequent turning (low equipment and staffing requirements) • Works best when feedstock contains large amounts of wood chips or bark • No electric power needed	• Large area required • No means of controlling odours, which may drive a need for larger buffer areas around the site • Lower ability to manage pile moisture • Spontaneous combustion is more likely • Slow decomposition rate • Exposure to rain, wind, and cold can be problematic
Passively-Aerated Pile	• Same as static pile technology	• Same as static pile technology • Piles can be awkward to construct
Windrow	• Can handle feedstocks with lower Carbon to Nitrogen (C:N) ratios or porosity than static piles • Relatively-low capital costs and low technology requirements (windrow turners, front-end loaders, or farm equipment will suffice) • Relatively low operating costs • No electric power needed • Large amount of practical experience	• Large area required • More labour-intensive than static piles, particularly for feedstocks with low C:N ratio or porosity • No odour control, which may require larger buffer area between site and neighbours • More challenges to overcome if food waste or biosolids are included • Exposure to rain, wind, and cold can be problematic
Aerated Static Pile (outdoor)	• Forced aeration reduces land requirements • Use of negative aeration can help avoid odour problems • Smaller surface area relative to windrows reduces impacts of cold weather and infiltration of rain • Lower operating costs and shorter processing times • Material handling requirements are less than windrow system (no turning required) • Lower risk of spontaneous combustion	• Slightly higher capital cost for forced-aeration equipment • Over-aeration can remove moisture • Feedstock pre-processing requires a higher degree of care; feedstocks must be well mixed and properly sized and moistened • More operator skill required to manage aeration systems • Aeration systems generally require three-phase electrical supply
Turned Mass Bed	• Small surface area/volume improves heat retention • Efficient use of available space • Efficient material handling • Forced aeration can be used to reduce processing time requirements and avoid odour problems	• Specialized windrow turner has higher capital cost than towed and smaller straddle-type turners • Capital cost is increased if forced-aeration system is used • Combination of over-aeration and turning can lead to excessive moisture loss from the piles
Aerated Static Pile (enclosed)	• Moderate capital and operating costs • Usually in buildings, so better odour control • Lower space requirements than windrow systems • Contained system reduces potential for odour emissions and contaminated storm water	• Potential steam or dust issues inside the enclosure • Indoor air must be managed in odour control system prior to release • Operating and maintenance expertise required
Channel and Agitated Bed (enclosed)	• Moderate capital and operating costs • Usually in buildings, so better odour control • Lower space requirements than windrow	• Lacks flexibility in dealing with variable feedstock volumes • Large volume of foul process air to be managed • Operating and maintenance expertise required • Higher capital/operating costs than windrow
Tunnel	• Design of tunnel system leads to small headspace and high degree of odour control	• Moderate to high capital costs • Generally has shorter residence time (2 to 4 weeks) and used in combination with another composting method/technology.
In-vessel	• High degree of odour control • Low space requirements	• Operating and maintenance expertise required • Higher capital and operating costs. • Generally has shorter residence time (1 to 4 weeks) and used in combination with another composting method/technology.

EXHIBIT 4-2

COMPOST TECHNOLOGY ASSESSEMENT

Technology Class	Demonstrated Capability for L&YW	Odour & Nuisance Control	Maintenance Requirements	Staffing Needs	Capital Cost	Operating Cost	Space Requirements	Typical Processing Time	Small	Medium	Large
Static Pile	Yes	Low	Low	Low	Low	Low	Very Large	2 to 3 years	✓		
Passively Aerated Static Pile	Yes	Low	Low	Low	Low	Low	Large	1 to 2 years	✓		
Windrow	Yes	Low - Moderate	Low	Low - Moderate	Low - Moderate	Low - Moderate	Large	3 to 12 months	✓	✓	✓
Aerated Static Pile (outdoor)	Yes	Low - High[1]	Low	Low - Moderate	Low to Moderate	Low - Moderate	Moderate to Low	3 to 6 months		✓	✓
Turned Mass Bed	Yes	Low - Moderate	Moderate	Low - Moderate	Low – Moderate	Low - Moderate	Moderate to Low	3 to 6 months			✓
Aerated Static Pile (enclosed)	Yes	High	Low	Low - Moderate	Moderate to High	Low - Moderate	Moderate to Low	3 to 6 months			✓[2]
Channel and Agitated Bay	Yes	High	Moderate to High	Low - Moderate	High	High	Moderate to Low	3 to 6 months			✓[2]
Tunnel	Yes	High	Moderate to High	Low - Moderate	High	High	Moderate to Low	3 to 6 months			✓[2]
In-Vessel	Yes	High	Moderate to High	Low - Moderate	High	High	Moderate to Low	3 to 6 months			✓[2]

Notes:

1. High odour control requires the use of negative aeration and/or covered aerated static pile systems.
2. May be appropriate at sensitive locations where a higher degree of nuisance and odour control is required, and capital costs can be justified.

5 L&YW Composting Facility Conceptual Designs

5.1 Typical L&YW Composting Facility Design Features

This section outlines the typical design and operating features of L&YW composting facilities. These design features are based on the requirements outlined in the Draft *Standard for Composting Facilities in Alberta* (the "Standards") and best management practices. A copy of the Standard is provided in Appendix A.

5.1.1 Working Surfaces

Active operating areas include all those areas used for feedstock receiving and storage, pre-processing, composting, and curing. Working surfaces in these areas should be constructed to withstand the expected wear and tear from site equipment, and from vehicles delivering feedstocks and removing finished products.

Concrete and asphalt are the most desirable working surfaces, but their capital costs are often prohibitive at small and medium composting facilities. Typical working surfaces used at smaller facilities include recycled asphalt, crushed concrete, lime-amended soils, and gravel, but these can lead to physical contamination of finished products. Topsoil and wood chip working surfaces have been used successfully, but can result in increased rutting or traction problems for site equipment. Clay working surfaces are not recommended due to traction issues.

5.1.2 Roads and Vehicle Access

Deliveries of L&YW feedstock to composting facilities, and removal of finished product, is done using vehicles that range from passenger cars and trucks to waste collection trucks (i.e., roll-offs), dump trucks and end dumps. At medium and large scale facilities, feedstock receipts and product shipments using walking floor trailers are also common.

Geometric design of access roadways and maneuvering areas within the composting facility must be able to accommodate these vehicle types. Roadway and working surfaces should be designed to bear the weight of these vehicles without rutting.

5.1.3 Winter Access

The need to maintain access within the composting facility during the winter months depends upon the basis of operation and turning schedule. At facilities that involve a high-degree of management, year-round access may be necessary. Most small L&YW composting facilities in Alberta are not actively managed during the winter, and thus access is not maintained.

5.1.4 Site Security

Provision of security at L&YW composting sites is necessary both to control illegal and uncontrolled dumping, and to reduce the incidence of vandalism.

Where the composting operation is located within the boundaries of an existing landfill or transfer station, it is relatively easy to extend or modify existing perimeter fencing. Stand alone facilities will require new fencing or physical barriers (e.g. trees, berms).

5.1.5 Setbacks and Buffer Zones

Minimum setback distances from residences, restaurants, hospitals, and other commercial establishments are similar to those of landfills. Setback distances are specified by the "Subdivision and Development Regulation," and are also contained in the Standards.

The minimum distances shown in Exhibit 5-1 should be adopted for L&YW composting facilities.

5.1.6 Flood Plains

Compost facilities should not be situated in areas that are subject to flooding. The accepted best management practice is that a facility should not be located within a 1:100 year flood plain.

5.1.7 Site Drainage and Leachate Management

Management of surface water and leachate is necessary to prevent uncontrolled releases to the environment that will result in adverse effects. Surface water that has come in contact with composting feedstocks, or which has been contaminated by run-off from receiving, pre-processing, composting, and curing areas can be high in biological oxygen demand (BOD), suspended solids, and nutrients.

EXHIBIT 5-1
BUFFER ZONE DISTANCES

Setback Type	Distance
From property line	30 m
From nearest permanent residence	300 m
From nearest hotel, restaurant, food processing facility, school, church, or public park	300 m
From nearest commercial/industrial occupancies	300 m
From nearest water supply intake, private well, or other potable water source	100 m
From nearest spring	100 m
From natural surface water bodies	30 m
From drainage ditches/pipes leading to natural surface water bodies	30 m

In order to minimize the potential for contamination of surface waters (which, in turn, increases leachate management requirements), surface water from areas outside of the composting facility should be diverted around or away from composting operations through ditches, swales, berms, or other conveyance methods.

To avoid the impacts that could potentially result from the release of contaminated surface water, the following design measures should be incorporated into the facility:

- Working surfaces in receiving, pre-processing, composting, and curing areas should be constructed of an impermeable surface or underlain by an engineered liner to prevent downward and lateral migration of leachate into groundwater.

- Run-off generated within the facility's receiving, pre-processing, composting, and curing areas should be collected in a detention pond and managed as leachate.
- Working surfaces in processing areas should be sloped at a minimum of 0.5% to promote drainage.
- All drainage controls and conveyances should be designed such that the potential for erosion and sediment transport is minimized. Use of filter berms, bioswales, and erosion blankets constructed from compost should also be incorporated into drainage controls, where possible.

The leachate detention pond should be designed to manage the run-off from a 1:25 year, 24-hour storm event. In areas is subject to seasonal droughts, additional capacity should be included in the detention pond for "dead storage" of run-off that can be used as a source of supplemental water for the composting operations and fire control.

Performance requirements for the detention pond liner system are specified in Section 3.3 of the Standards. It requires that there be a 1-m vertical separation between the bottom of the liner and the seasonally high groundwater table, and that the liner provide the equivalent protection of a 1-m-thick clay liner with a hydraulic conductivity of 1×10^{-9} m/s. The Standards make an allowance for use of a "natural protective layer" in lieu of a liner if certain conditions are met.

Depending upon leachate characteristics and the levels of nutrients and contaminants, management options for surplus leachate include reuse within the composting process, spray-irrigation on adjacent lands, release to nearby surface water bodies (if appropriate approvals are obtained), and off-site disposal at a licensed wastewater treatment facility.

5.1.8 Compost Pad Liner Requirements

In order to provide requisite protection of groundwater resources, the Standards require that a liner be provided under the following areas of a Class 2 composting facility:

- feedstock receiving and amendment storage areas.
- active composting areas.
- curing areas.

The performance requirements for the liner system are specified in Section 3.2 of the Standards. Specifically, there must be a 1-m vertical separation between the bottom of the liner and the seasonally high groundwater table, the liner must be sloped to prevent ponding, and the liner must provide the equivalent protection of a 0.5-m-thick clay liner with a hydraulic conductivity of 1×10^{-9} m/s. The Standards also make an allowance for use of a "natural protective layer" in lieu of a liner if certain conditions are met.

At smaller outdoor compost facilities, it is not uncommon for operations to be relocated within the facility over the course of the operating season or from year to year. For example, as new windrows are constructed, the feedstock receiving area might be moved closer to the new windrows as a means of reducing material handling requirements. For this reason, it is advisable that the entire composting pad be underlain with an appropriate liner to ensure that operational changes do not result in activities being inadvertently conducted in non-lined areas.

5.1.9 Fire Protection

Due to the nature of the materials that are to be processed at the facility, features that will minimize the risk of fires starting and spreading should be incorporated into its design and operation. These include:

- The composting facility should be designated as a non-smoking area.
- Stationary and mobile equipment should be blown down using compressed air on a regular basis to prevent accumulation of dust and other debris in and around engine compartments and exhaust systems.
- Conditions in amendment and product stockpiles, as well as composting and curing windrows, should be monitored regularly for conditions that could lead to spontaneous combustion.
- Storage piles of dry amendments should be limited to 4.5 m (15 ft) in height.
- Aisles should be maintained between amendment and product storage piles to allow for equipment or fire truck access in the event that a fire occurs.
- Necessary firefighting equipment, including portable pumps, hoses, and mobile equipment, should be stored on-site at all times and maintained in a workable condition.

5.1.10 Odour Management

Odourous emissions are a byproduct of the biological degradation process that occurs during the composting process. However at a properly designed and operated facility, these emissions should not be excessive or become a nuisance either on-site or at neighbouring properties.

At outdoor facilities which use static-pile or windrow-composting methods, the degree of control that the design has over odours is very limited relative to an enclosed or in-vessel facility. Odour control at these types of operations is primarily achieved through the implementation and maintenance of good operating practices.

The following design components should be incorporated into L&YW facilities:

- Working surfaces should be sloped at a minimum of 0.5% to promote drainage of leachate and run-off.
- Working surfaces should be designed to provide all-weather access for site equipment, and to resist rutting and settlement which can lead to water/leachate ponding.
- Windrows should be oriented parallel to the slope of the composting pad to promote drainage and prevent the base of windrows from becoming saturated.

In addition to these basic requirements, it may be necessary to provide on-site treatment of leachate so that it doesn't become an odour source during operation of the facility. Aeration using solar-powered or electrical aerators is a common practice for managing odours from leachate and surface water ponds.

5.1.11 Nuisance Control

Like odours, nuisance conditions, including: dust, litter, and insect attraction, are managed primarily through the implementation of good operating practices. Dust and litter can be controlled through design features, such as hard-surface roadways and temporary or permanent litter fences.

Actively composting yard waste can provide a breeding habitat for flies. However, through frequent turning and maintenance of pile optimal temperatures during the initial weeks of composting, the fly larvae cycle can be disrupted and flies controlled.

Attraction of wildlife to L&YW composting piles is generally not problematic and should not require special precautions or practices.

5.1.12 Amendment Storage

Depending upon the operational philosophy and composting technology, it may be necessary to mix amendments with incoming feedstocks to achieve optimal composting conditions. At the very least, it is a good operating practice to maintain a supply of carbonaceous amendments at L&YW composting sites (particularly in the summer months) so that particularly odourous feedstocks can be quickly amended as they arrive.

Amendments such as dry leaves, straw, wood chips, and sawdust are high in carbon, and can normally be stored for long periods without a risk of them contributing to nuisance odours. However, these amendments should ideally be kept in a confined area to prevent them from being carried away by wind. Stockpiles should always be sized and managed with spontaneous combustion in mind. Amendment stockpiles should also be situated over lined areas in accordance with the requirements of the Standards.

5.1.13 Product Storage

A composting facility's inventory of finished product must be stored in a manner that preserves the product's quality (e.g., prevents weed propagation and pathogen reintroduction). Stockpiling finished compost in piles up to 4.5 m high using front-end loaders, or up to 10 m high using stacking conveyors, is a common practice for storing inventory in a small area.

According to the Standards, there is no requirement for an engineered liner below compost storage areas. However, storage areas should be designed with a suitable working surface that allows for all-weather access and is suitably graded to facilitate surface water drainage.

5.2 Conceptual L&YW Composting Facility Designs

In order to quantify development requirements and overall costs of the composting infrastructure needed to support a province-wide L&YW strategy, order-of-magnitude costs for three different sizes of L&YW composting facilities were developed. These cost estimates were based on specific design features, operating approaches and equipment types.

The conceptual designs and cost estimates for each of the three "typical" facilities are outlined in the following sections.

5.2.1 Small Scale L&YW Facility (<1,000 tpy)

Many of the existing L&YW composting facilities in the province fall into the small-scale category, processing less than 1,000 tonnes per year of feedstocks. This conceptual design is intended to represent a typical facility capable of processing 500 tonnes per year of L&YW in accordance with the requirements for Class III facilities contained in the Standard.

5.2.1.1 Design and Operating Basis

For small-scale L&YW composting, a windrow approach with a low level of monitoring and management is appropriate. Although it allows for lower operating costs, the use of static piles is not recommended due to the higher potential for nuisance conditions and odours.

Windrows at the small-scale facility would be formed and turned with a small to moderately sized front-end loader (e.g. Case 521). This would allow construction of windrows approximately 7 to 8 m wide and 3 to 4 m high. If a front-end loader is unavailable, a smaller skid steer loader could be used instead, although the resulting windrows would be smaller and land requirements would increase somewhat.

Feedstock receiving, active composting and curing would take place on a 60 m long by 45 m wide composting pad designed in accordance with the Standards. This would provide enough space for three windrows, well as an area for stockpiling of L&YW feedstocks and wood waste.

The pad would consist of a gravel base/sub-base overlying a 0.5 m thick compacted clay liner. A 150 m^3 surface water detention pond would be included to manage run-off from the composting pad in addition to storage of water for use in the composting process. The pond design is based on use of a 0.5 m thick synthetic liner.

L&YW feedstocks delivered to the site would be unloaded directly into active windrows to minimize handling requirements. Pre-processing would consist of visual inspection and manual contaminant removal by composting facility personnel when material is unloaded.

Windrows would be formed and added to between May and September using L&YW feedstocks that are delivered during the spring and summer. Leaves delivered and stockpiled at the site during the previous fall would be used as a carbon amendment. The windrows would be allowed to compost and cure for approximately 12 months, and screened in the summer of the following year.

Brush and wood waste collected throughout the year would be stockpiled at or adjacent to the composting site (but outside of the composting pad boundaries) and ground every one to two years subject to having sufficient quantities. The ground material would be used as an additional amendment in the composting process.

Windrow turning would be dictated by temperature monitoring results, but would normally be done every three to five weeks. Monitoring of windrow temperatures and conditions would be done weekly. Turning and windrow monitoring would not be done during the winter months (e.g. November through April) however the facility would be periodically inspected.

Water required for the composting process would be pumped from the detention pond and distributed over the windrows manually using a portable pump and hoses.

Post-processing of finished compost would be limited to screening with a portable trommel equipped with 3/8" or 1/2"screens. Over-sized materials from the product screening would be reused within the composting process or disposed of, depending upon the level of foreign matter contamination.

Finished product would be stored in stockpiles 4 to 5 m high in a graded but unlined area adjacent to the composting pad.

5.2.1.2 Staffing and Equipment Requirements

Given the limited effort involved in this size of operation, it is expected that the duties can be shared between one or two existing full-time employees within a municipality's Public Works Department. The level of commitment during the active composting season (May through September) is anticipated to be in the order 3 to 5 half-days per month.

The following equipment will be required to support this operation:

- Wheel loader (e.g., Case 521 or equivalent size equipped with a standard bucket) on a part time basis;
- Sampling and monitoring equipment (e.g., thermometer, oxygen probe, sampling tools, scales)
- Dedicated firefighting equipment, including: extinguishers, pumps, and hoses
- A portable pump and hoses for water addition

Grinding of feedstocks and screening of finished product will be outsourced as necessary, rather than purchasing necessary equipment.

5.2.1.3 Cost Estimates

The order of magnitude cost estimate for design and development of the conceptual small-scale facility outlined above is in the order of $120,000, inclusive of contingencies, mobilization and construction supervision. This corresponds to approximately $240 per tonne of capacity. A breakdown of this cost estimate is provided in Appendix B. Land acquisition costs are not included in this estimate.

Dedicated site equipment requirements for a facility of this size are minimal and are estimated to cost in the order of $2,000.

It is unlikely that dedicated mobile equipment would be purchased to support an operation of this size. More likely, the mobile equipment would be shared with other municipal departments, or the services would be outsourced to a local contractor.

Operating costs for the small scale facility are estimated to be $25,000 to $30,000 per year, which includes $8,500 for contracted screening and wood grinding. This corresponds to $50 to $60 per tonne of L&YW processed.

5.2.2 Medium Scale L&YW Facility (1,000 to 10,000 tpy)

An inventory of composting facilities prepared by CH2M HILL shows that the average capacity of medium-sized L&YW facilities in Alberta is in the order of range of 4,000 tonnes per year.

Examples of compost facilities in this size range include the operations at the Foothills Landfill, Roseridge Landfill, and Red Deer Landfill.

Based on this, the conceptual design prepared for a typical medium scale L&YW facility is based on a capacity of 4,000 tonnes per year.

5.2.2.1 Design and Operating Basis

At a facility of this size, composting in windrows would be the most appropriate approach. However, the level of monitoring and management involved would be higher than for the conceptual small-scale facility previously outlined.

Windrows would be formed with a front-end loader, but would be turned using a windrow turner towed behind the front-end loader (e.g. Wildcat TS616 or similar). This would result in windrows that are 4.5 to 5 m wide and 1.5 to 2 m high.

Feedstock receiving, active composting and curing would take place on a 110 m long by 235 m wide composting pad designed in accordance with the Standards. The pad would consist of a gravel base/sub-base overlying a 0.5 m thick compacted clay liner. Access lanes would be provided around the perimeter of the pad to allow for movement of site equipment and vehicle traffic. This size of pad would allow for 24 windrows as well as space for storage of incoming L&YW feedstocks, brush, and wood.

A 2,800 m^3 surface water detention pond would be included to manage run-off from the composting pad and provide dead storage of run-off for process requirements. The pond design is based on the use of a synthetic liner.

L&YW feedstocks delivered to the site would be unloaded in a temporary storage location at the facility, or directly into active windrows, depending upon the source of the material. Pre-processing would consist of visual inspection and manual contaminant removal by composting facility personnel when material is unloaded.

Windrows formed in the early spring of each year from dry, high-carbon materials (e.g., leaves, dried grass) will be amended with green grass during the late spring and summer of the same year. These materials would be allowed to compost and cure during the following 8 to 12 months, and will be screened in the early spring of the following year. Leaves and other carbonaceous feedstocks received in the fall of each year will be stockpiled and used as carbon-amendments the following season.

Brush and wood waste collected throughout the year would be stockpiled at or adjacent to the composting site (but outside of the composting pad boundaries) and ground on at least an annual basis. The ground material would be used as an amendment for grass and leaves, with any surplus materials being composted on its own.

During active composting, the windrows would be turned two to three times per week during the initial 2- to 3-week period after they are formed so that pathogen reduction protocols can be met. Afterwards, turning requirements will be dictated by temperature monitoring results and is expected to be less frequent. Monitoring of windrow temperatures and conditions would be done at least twice per week.

Turning and windrow monitoring during the winter months (e.g. November through March) will be infrequent and subject to ambient temperatures.

During the active composting and curing stages, two or more windrows will be combined together into a single windrow to take advantage of material shrinkage and minimize the overall composting pad development requirements. Following the active composting stage, materials will be cured in-place to minimize material handling requirements.

Water required for the composting process would be pumped from the detention pond and distributed over the windrows during or following turning using a small hard-hose reel system.

Post-processing of finished compost would consist of screening using a portable trommel to remove oversized particles and foreign matter. Screen size will be dictated by the end-use of the product, but would be expected to range from 3/8" to 1/2". Over-sized materials from the product screening would be reused within the composting process or disposed of, depending upon the level of foreign matter contamination.

Finished product would be stored in stockpiles 4 to 5 m high in a graded but unlined area adjacent to the composting pad.

5.2.2.2 Staffing and Equipment Requirements

Given the nature and size of the operation, staffing requirements for waste receiving and inspection, site operations (e.g., windrow formation, turning), and monitoring process and site conditions are expected to be in the order of 2 to 3 days per week during the period from May through September.

It is anticipated that broader management of the composting facility can be incorporated into the duties of existing municipal supervisors.

The following equipment will be required to support this operation:

- Wheel loader (e.g., John Deere 644 or equivalent size) equipped with an oversized bucket;
- Towed windrow turner (e.g. Wildcat 616 or similar);
- Hard-hose reel and associated water pump
- Sampling and monitoring equipment (e.g., thermometer, oxygen probe, sampling tools, scales)
- Dedicated firefighting equipment, including: extinguishers, pumps, and hoses

Grinding of feedstocks and screening of finished product will be outsourced as necessary, rather than purchasing necessary equipment.

5.2.2.3 Cost Estimates

The cost of designing and constructing the conceptual medium-scale facility outlined above is in the order of $900,000, excluding land acquisition. This corresponds to approximately $225 per tonne of capacity. Water addition equipment (e.g. hard hose reel) monitoring equipment, and fire fighting is estimated to have a combined cost in the order of $15,000. A breakdown of this cost estimate is provided in Appendix B.

As with the small facility, it is unlikely that a dedicated front-end loader would be purchased to support an operation of this size. More likely, the mobile equipment would be shared with other municipal operations, or the services would be outsourced to a local contractor. However, the compost windrow turner is a specialized piece of equipment and would have to be purchased. Cost of a turner is in the order of $85,000.

The combined cost of facility development and dedicated equipment (excluding the front-end loader) is in the order of $250 per tonne of capacity.

Operating costs for the medium scale facility are estimated to be $90,000 to $100,000 per year, which includes $16,000 for contracted screening and wood grinding. This corresponds to $22 to $25 per tonne of L&YW processed.

5.2.3 Large Scale L&YW Facility (10,000 to 20,000 tpy)

The use of windrow composting to handle this amount of L&YW material is still appropriate. Indeed, windrow composting facilities existing in the United States that process in excess of 20,000 tpy in windrows. There are currently no examples of large-scale L&YW composting facilities in Alberta, although there are several large feedlot composting operations in this size range. The curing operation associated with the Edmonton Co-composting Facility would be similar in scope to a L&YW composting operation of this size.

Although windrow composting is appropriate, there may be certain circumstances that require the use of a different composting method to provide greater control over nuisances and odours. For example, if the available sites to host a composting facility are close to sensitive neighbours, or if development were to encroach on an existing composting facility, the use of aerated static pile composting may be more appropriate.

For the purposes of this evaluation and quantifying development requirements for the province-wide L&YW strategy, the cost estimates for the large-scale facility will be based on a windrow composting approach and a capacity of 15,000 tpy.

5.2.3.1 Design and Operating Basis

Given the quantity of feedstock that is being processed, and the potential for significant nuisance conditions to develop, the level of monitoring and management involved in a large-scale windrow operation could be significant, and would require the dedication of staff and equipment.

The facility would consist of a 140 m long by 225 m wide composting pad designed in accordance with the Standards, with specific designated areas for feedstock receiving and temporary storage, active composting and curing, and screening/product storage. The pad would consist of a gravel base/sub-base overlying a compacted clay liner. Gravel surfaces in the receiving area would be strengthened to withstand the high amount of delivery vehicle traffic. Access lanes would be provided internally and around the perimeter of the pad to allow for movement of site equipment and vehicle traffic.

As at the medium-sized facility, feedstocks would be unloaded in a temporary storage location at the facility, or directly into active windrows, depending upon the source of the material. Pre-processing would consist of visual inspection and manual contaminant removal by composting facility personnel when material is unloaded.

Materials would be transferred from the temporary storage area to the active compost windrows using a front-end loader. The windrows would be turned using a small straddle-type turner capable of creating windrows approximately 5.5 m wide and 2 m high.

Windrows would be constructed continuously and sequentially during the spring, summer and fall. Leaves received in the fall of each year will be stockpiled and used as carbon-amendments the following season. Brush received throughout the year would be periodically ground and used to further amend the incoming feedstocks.

During active composting, the windrows would be turned two to three times per week during the initial 3 to 5 weeks after they are formed so that pathogen reduction protocols can be met and process conditions can be optimized. Afterwards, turning requirements would be dictated by temperature monitoring results and are expected to be less frequent. Monitoring of windrow temperatures and conditions would be done at least twice per week.

Turning and monitoring of actively composting windrows would continue during the winter months (e.g. November through March) although at a reduced schedule due to cold weather. Curing windrows would not normally be turned during this period.

During the active composting and curing stages, windrows would be combined together into a single windrow to take advantage of material shrinkage and minimize the overall composting pad development requirements. Following the active composting stage, materials will be cured in-place to minimize material handling requirements.

Finished compost would be screened in the fall of each year and stockpiled (in an unlined product storage area adjacent to the composting pad) for distribution the following spring. Compost that is not fully matured in the fall, but would be ready for distribution in the spring (i.e. after additional curing over the winter) would also be screened, but would be stockpiled in smaller piles or windrows on the composting pad.

Screening would be done with a portable trommel equipped with 3/8" or 1/2" screens. Oversized materials from the product screening would be reused within the composting process or disposed of, depending upon the level of foreign matter contamination.

A 2,100 m^3 surface water detention pond with associated synthetic liner would be used to capture run-off from the composting pad and provide process water. Water required for the composting process would be pumped from the detention pond and distributed over the windrows during or following turning using a small hard-hose reel system.

5.2.3.2 Staffing and Equipment Requirements

Given higher level of management and monitoring associated with this size of composting operation would drive the need for trained and dedicated personnel. The workload associated with waste receiving and inspection, windrow formation, turning, and windrow monitoring is expected to be in the order 4 to 5 days per week during the active composting season (i.e. May through October), and 2 to 3 days per week during the winter season. These duties could be shared between two to three staff positions rather than hiring a single person to manage the site. However, if multiple staff will be involved with the operation, one person should be designated as being responsible for process related decisions to minimize confusion.

The following equipment will be required to support this operation:

- Wheel loader (e.g., John Deere 644 or equivalent size) equipped with an oversized bucket;
- Self propelled, straddle-type windrow turner (e.g. Wildcat 718 or similar);
- Hard-hose reel and associated water pump
- Sampling and monitoring equipment (e.g., thermometer, oxygen probe, sampling tools, scales)
- Dedicated firefighting equipment, including: extinguishers, pumps, and hoses

Any required grinding of brush and trees would be outsourced as necessary throughout the year, rather than purchasing necessary equipment. Screening of finished product would also be contracted out, although in reality there may be a business case to support the purchase of a small trommel screen in areas where contractors are not readily available and mobilization/demobilization costs are high.

5.2.3.3 Cost Estimates

The cost of designing and constructing the large-scale facility outlined above is in the order of $1,100,000 (excluding land acquisition), which corresponds to approximately $75 per tonne of capacity. Water addition equipment (e.g. hard hose reel) monitoring equipment, and fire fighting is estimated to have a combined cost in the order of $15,000. A breakdown of this cost estimate is provided in Appendix B.

For a facility of this size, the increased amount of material handling warrants a dedicated front-end loader rather than sharing the using with other operations. It would generally not be cost effective to outsource front-end loader services; rather a unit would be purchased or leased. The compost windrow turner would also be used sufficiently to justify purchasing/leasing a unit and dedicating it to the site. The cost of the loader and windrow turner are, respectively, $225,000 and $350,000.

The combined cost of facility development and dedicated equipment capital costs is in the order of $115 per tonne of capacity.

Operating costs for the large scale facility are estimated to be $150,000 to $175,000 per year, which includes $28,000 for contracted screening and wood grinding. This corresponds to between $10 and $12 per tonne of L&YW processed.

5.3 Comparison of Site Development Costs

A comparison of the total development and annual operating costs for the composting facilities outlined herein is presented in Exhibit 5-2, and is shown graphically in Exhibit 5-3 and 5-4.

As expected, the total development costs and total operating costs increase with increasing facility size. As demonstrated by Exhibits 5-2 and 5-3, these costs appear to follow a logarithmic relationship with respect to facility size.

EXHIBIT 5-2

SUMMARY OF DEVELOPMENT AND OPERATING COSTS

		Small Scale Facility (500 tpy)	**Medium Scale Facility** (4,000 tpy)	**Large Scale Facility** (15,000 tpy)
Development and Equipment Costs	**Total ($)**	122,200	1,000,000	1,690,000
	Per Tonne of Capacity ($/tonne)	244	250	113
Annual Operating Costs	**Total ($)**	25,000 to 30,000	90,000 to 100,000	150,000 to 175,000
	Per Tonne of Capacity ($/tonne)	50 to 60	23 to 25	10 to 12

EXHIBIT5- 3

TOTAL DEVELOPMENT COST VS FACILITY SIZE

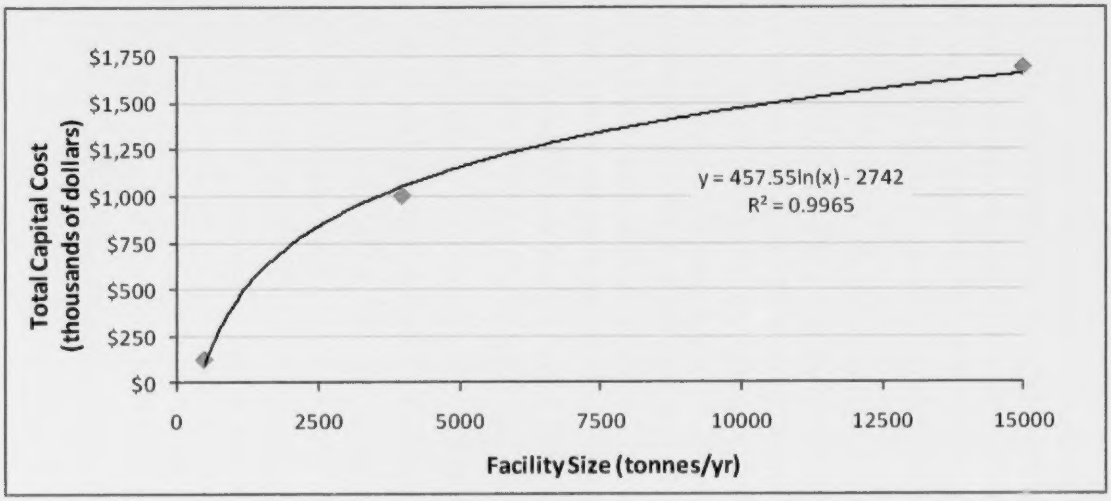
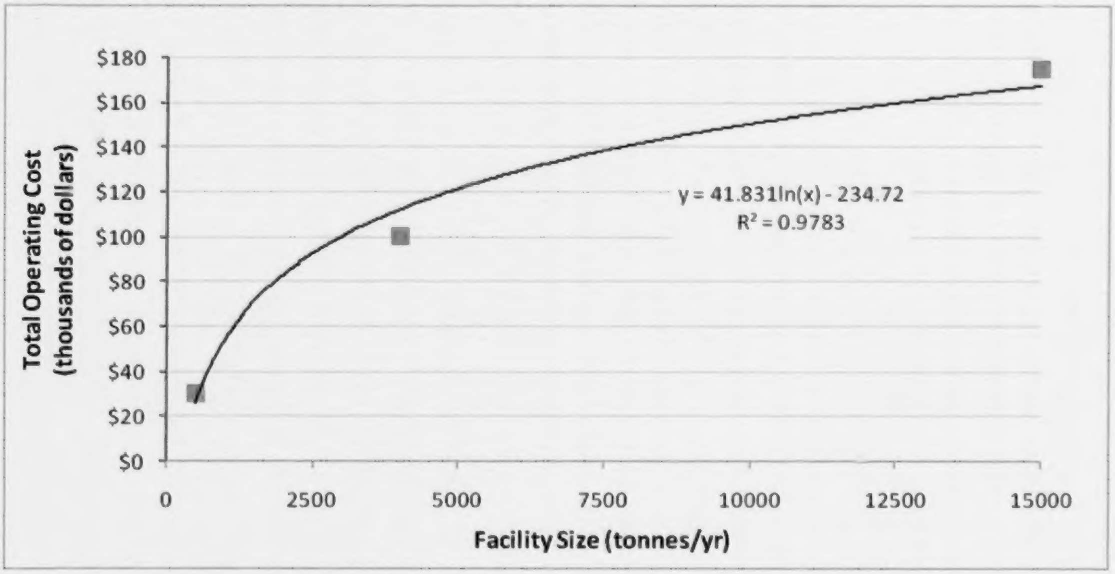


EXHIBIT 5- 4

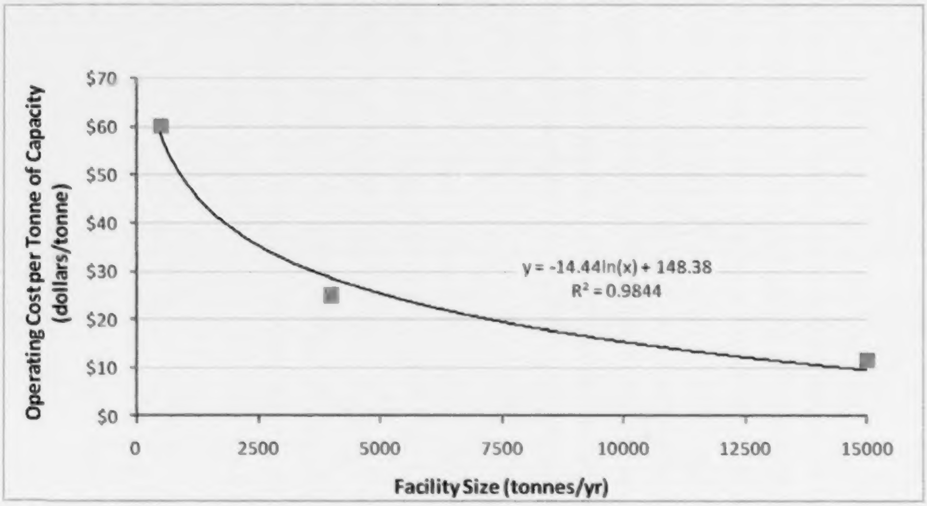
ANNUAL OPERATING COST VS FACILITY SIZE



As shown in Exhibit 5-5, the operating costs per tonne decreases with facility size, again with an apparent logarithmic relationship. Once again this is expected and can be attributed to an "economies of scale" effect.

EXHIBIT 5-5

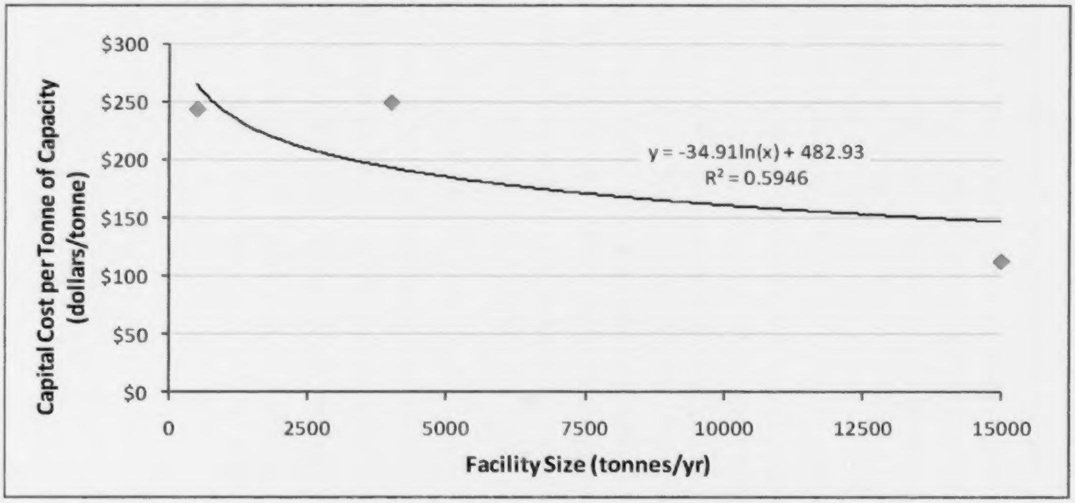
ANNUAL OPERATING COST PER TONNE VS FACILITY SIZE



When development costs are translated to a cost per tonne of capacity, costs are roughly equal for the small and medium-sized facility. Thus, a logarithmic relationship shown in Exhibit 5-6 provides a poor fit for this scenario. While the economies of scale concept still applies (i.e. for facilities larger than some threshold, there is a lower capital cost per unit tonne), it may be more appropriate to model the cost curve as a step function (i.e. a constant cost per tonne followed by a logarithmic decrease after a particular facility size threshold is passed). Three data points, however, are insufficient to predict the threshold value.

EXHIBIT 5-6

CAPITAL COST PER TONNE OF CAPACITY VS FACILITY SIZE



5.4 Factors affecting Site Development and Operating Costs

Site development and operating costs are affected by a number of factors. One of the most obvious factors that affects site development is the cost of acquiring land for the composting facility. In many cases, medium-sized facilities can be sited at existing landfills, and small-scale site can be accommodated at public works yard or transfer station. However this may not always be the case. It may also be difficult to accommodate the footprint of a large-scale facility into an existing landfill.

The topography and geology of the site on which the facility is constructed will also impact construction costs. For example, topsoil thickness will affect the amount of clearing and stockpiling/preservation required, and the presence of bedrock outcrops may create a need for blasting. Uneven ground can increase costs of rough grading.

The distance of the facility from existing roadways will determine the length of access roads required. The size of vehicles accessing the site (e.g. passenger vehicles vs. dump trucks) and the expected traffic levels will also impact access road design.

Construction costs can vary significantly throughout the province and also from year to year based on economic conditions and availability of contractors.

Specialized equipment such as compost windrow turners is typically manufactured in US or in Europe. Thus the price of these units will be subject to fluctuations in the Canadian-US or Canadian-Euro exchange rate.

The cost of designing and installing an engineered liner (e.g. compacted clay or synthetic), and completing the associated quality control testing during construction, can be significant. In the case of the medium and large-scale conceptual facilities outlined above, liners below the composting pad and surface water pond account for almost 50% of overall construction costs. The Standard allows for use of a natural clay layer if certain conditions are met, and in many areas of Alberta it is possible to realize significant cost savings as a result.

Composting operations rely heavily on mobile equipment, and thus operating costs can be affected by variations in fuel pricing. In many situations were compost (or landfill) operations are outsourced by a municipality, clauses dealing specifically with fuel cost increases are included in the contracts.

In areas that are outside of the major population areas and the Edmonton-Calgary corridor, access to contractors for screening and grinder may be limited. As a result, the costs of these services will be higher as a result of increased mobilization and demobilization costs.

6 Compost Product Quality Requirements

Quality criteria for finished compost products are necessary to protect human health and prevent environmental degradation. Criteria are also beneficial in that they help ensure product satisfaction and maintain consumer confidence. For these reasons, development of science-based standards, and documented adherence to these standards by producers, is fundamental to the continued expansion and strengthening of the composting industry in Canada.

Criteria generally fall into the categories of public health/environmental protection, fertility, and aesthetics. Regulatory standards are generally limited to the protection of public health and the environment and fertility criteria. Aesthetic criteria, which address the texture, color, composition, and aroma of the product, are more often industry-developed and voluntary in nature.

6.1 Regulatory Requirements

In Alberta, compost product quality criteria for health and safety and environmental factors are mandated by Alberta Environment and the Canadian Food Inspection Agency. The Canadian Food Inspection Agency also ensures consumer protection through its enforcement of the product labeling requirements of the Fertilizer Act and associated regulations.

6.1.1 Alberta Environment

Alberta Environment's regulatory approach is based on the premise that mature compost that has met minimum quality parameters should not pose environmental concerns when land applied. Therefore it does not regulate the land application of compost that has met these minimum requirements, provided land application guidelines are adhered to.

This approach is contained in Section 5 of the *Draft Standard for Compost Facilities in Alberta*, which requires that compost produced at facilities regulated by Alberta Environment and that is "sold or given away" must meet certain minimum quality requirements. The Standard has been specifically worded to include compost which is given away, in order to close off a well known omission that exists in federal legislation governing compost quality and distribution.

If these minimum quality requirements are not met, then the compost must be disposed of at an approved waste management facility. Alternatively, the material can be used or disposed of in a manner specifically authorized by Alberta Environment.

As part of harmonization initiatives with other provinces, Alberta Environment has adopted the Canadian Council of Ministers of the Environment (CCME) *Guidelines for Compost Quality* as the minimum acceptable standards. As explained elsewhere in this guidelines, the *Guidelines for Compost Quality* contain quantitative criteria for maximum concentrations of trace elements, foreign matter and sharp foreign matter, minimum maturity and stability requirements, and pathogen reduction requirements.

6.1.2 Council of Ministers of the Environment

The Canadian Council of Ministers of the Environment is an "intergovernmental forum" of federal and provincial/territorial government representatives that work together to discuss and take joint action on environmental issues that have national implications. The CCME's goal is to encourage consistent standards, practices and legislation across Canada.

The Guidelines for Compost Quality were first published in 1996 following discussion and collaboration by the Provinces, Environment Canada, and Agriculture Canada (a CFIA predecessor). An updated version of the guidelines was published in 2005 following consultations amongst these groups and industry representatives.

The CCME guidelines include specific criteria for trace elements, pathogen levels, maturity, foreign matter (including "sharps"), and organic compounds. Two sets of criteria exist within the guidelines, which allow compost to be classified as either "Category A" or "Category B"[1]. The distinction between the two lies in differing criteria for trace elements and sharp foreign matter. Criteria for pathogens levels, maturity and organic compounds are the same for both categories.

The trace element and sharps criteria for Category A are more stringent than Category B, the intent of which is to allow for more flexibility in using Category A products. The trace element criteria for Category B are derived from (and are thus harmonized with) the federally mandated criteria contained in the Fertilizer Regulation administered by the Canadian Food Inspection Agency.

6.1.3 Canadian Food Inspection Agency

The Canadian Food Inspection Agency (CFIA) was created in 1997 through the amalgamation of inspection and related services provided by the departments of Agriculture and Agri-Food Canada, Fisheries and Oceans Canada, Health Canada and Industry Canada. This restructuring consolidated the delivery of all federal food, animal and plant health inspection programs into one organization.

The CFIA's role is to enforce food safety and nutritional quality standards established by Health Canada. It is also responsible for setting standards and carrying out enforcement and inspections related to animal health and plant protection. The CFIA delivers over a dozen specific inspection programs related to foods, plants and animals across Canada.

The CFIA is responsible for the administration and enforcement of the Fertilizer Act, Fertilizer Regulation and associated Trade Memoranda. As part of this, CFIA staff routinely sample fertilizers, fertilizer-pesticides and soil supplements to verify that products meet standards for safety. This is done through random inspections and product sampling at blending plants, manufacturing plants, processing plants, retail outlets and warehouses. The samples are tested for contaminants including heavy metals, pesticides and pathogens such as salmonella.

In accordance with the Fertilizer Regulation, the CFIA classifies compost as a "soil supplement" and all compost product sold are subject to certain minimum quality requirements. The quality requirements are outlined in Trade Memoranda that have been issued by the CFIA, most notably T-4-93 which establishes cumulative loading rates of trace element in soils (a copy of the memorandum is provided in the appendices). The CFIA has also set criteria for organic matter, moisture content, pathogens and compost maturity, however these criteria have not been published in the form of trade memoranda and are not well known. Similarly, the sampling and analytical methods used by CFIA in enforcing these criteria are not published and this has lead to regulatory enforcement problems at facilities in the past. Both these issues have been acknowledged by the CFIA, and they are working with the CCME to harmonize the two standards.

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[1] The terms "Category A" and "Category B" are specifically used in the CCME documentation. They should not be confused with, or used interchangedly with the terms "Class A" or "Class B" which are used to reference pathogen treatment levels for biosolids.

The Fertilizer Regulation also specifies labeling requirements for compost products that are sold. The labeling requirements include "guaranteed analysis" for organic matter and moisture content, instructions for use, and producer information. There are protocols for label sizes and fonts, as well as an extensive set of rules surrounding what claims can and can not be made on the label. While the CFIA's labeling requirements are extensive, they are not well documented or known, and as a result, not fully adhered too. Also, the requirements are not fully enforced by CFIA across all soil supplement industries, which leads to further confusion amongst producers and consumers.

It is well known by producers within the industry that the CFIA's regulations and requirements only apply to products that are sold. Thus, if a producer gives their product away, they do not have to meet any of the Fertilizer Regulation requirements for testing and labeling. In recent years the CFIA has broadened the application of the concept of "sold" to include any transaction where money changes hands. This eliminates the potential for a producer to circumvent the requirements by giving the compost away to a user, but charging them a monetary amount for "loading" the product or an inflated amount for transportation. Again this policy is not well documented in the public domain by the CFIA.

In response to requests from the composting industry for clarification of regulation and policy surrounding compost products under the Fertilizers Act, the Fertilizer Section and Fertilizer Safety Office of CFIA have developed a specific Trade Memorandum (T-4-120) for compost products. The CFIA also released information in 2007 on requirements for fertilizers and supplements in the context of the new program for animal health protection from BSE. Some of these requirements, which came into force on July 12, 2007, affect all compost products, but most are targeted to compost that contains so-called "prohibited materials"[2]. The new requirements include lot numbering, labeling, recall procedures, and record keeping.

6.2 Voluntary Product Standards and Programs

In several jurisdictions, voluntary standards have evolved to complement the regulatory standards. In most cases, this is because regulatory standards do not address agronomic issues that are important to compost users. In Canada, the Composting Council of Canada has developed a voluntary initiative called the Compost Quality Alliance. Through this program, compost producers participate in standardized testing and reporting of their product characteristics, and can provide comparisons with generally accepted agronomic criteria (e.g. EC, pH, soluble salt levels, etc.) for specific compost uses. A voluntary national standard has also been published by the Bureau de Normalisation du Quebec.

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[2] Prohibited material includes animal protein, including meat and bone meal, derived from animals that are mammals except horses and swine, poultry and fish. Blood meal, milk and gelatine from any mammal, ruminant tallow with less than 0.15% impurities, and manures and solids from municipal wastewater plants that do not receive SRM are specifically exempted.

6.2.1 Compost Quality Alliance

The Compost Quality Alliance (CQA) is a voluntary program developed and managed by the Composting Council of Canada. The program's goal is to improve consumer confidence in compost products through the use of standardized testing and reporting of product characteristics. The program has the benefit of helping consumers select the "right compost" for the intended use and will support regulatory compliance within the industry.

The CQA program is open to all compost producers, and focuses on final product quality instead of the process used to make the product. CQA participants follow prescribed sampling frequencies (based on annual production levels) and reporting methods, and through an annual licensing arrangement, use the CQA logo on packaging and product promotion.

Products marketed under the CQA banner are tested to ensure they meet the appropriate provincial quality guidelines (i.e. CCME criteria in Alberta) as well as certain key agronomic characteristics. The agronomic criteria include pH, carbon to nitrogen ratio, moisture, particle size, soluble salts (i.e. electrical conductivity), and sodium.

Product testing is completed by CQA recognized labs in Canada or the United States who are involved in the Compost Analysis Proficiency (CAP) program. CAP is a laboratory quality assurance program to calibrate procedures and evaluate inter-lab method performance, and is administered by Dr. Robert Miller of Colorado State University. The Test Methods for Examination of Composting and Compost forms the basis of the analytical test methods used in the CQA and CAP programs.

The Composting Council of Canada is also working with CFIA on a process for streamlining regulatory inspections and reporting for CQA members. Conceptually, as a result of the testing and reporting aspects built-in to the CQA program, the CFIA would place less emphasis on field inspections of CQA members, and focus more on non-CQA members. This may require regular voluntary reporting of final product quality to CFIA.

6.2.2 Bureau de Normalisation du Quebec

The Bureau de Normalisation du Quebec (BNQ) is an affiliated "daughter" organization of the Standards Council of Canada (SCC) that was established in 1961. As part of its mandate within the SCC framework, the BNQ is the organization responsible for establishing national standards for organic soil supplements.

The first national standard (CAN/BNQ -413-200 Organic Soil Conditioners - Composts) was published by the BNQ in 1997. This was developed through a consensus-based approach that involved product manufacturers, users, government agencies and interested parties. Minor amendments were made to the standard in 1997 and 1999. A major review and amendment was commenced in 2003 and an updated standard was published in 2005.

The national standard establishes three categories of compost (AA, A and B), and includes criteria for physical characteristics (moisture, organic matter, foreign matter, sharps), chemical characteristics (trace elements, maturity) and biological characteristics (fecal coliform, salmonella). Detailed sampling methods, and references to analytical method standards published by other standard setting agencies (e.g. USEPA, ASTM) are also included in the standard.

In addition to publishing the national standard, the BNQ also runs a voluntary certification program for producers. However, this program is quite expensive to participate in and is not well known or marketed by BNQ. As a result, it is not used by producers outside of Quebec, and only by a few producers within that province.

7 L&YW Compost End Uses and Markets

In order to obtain baseline data on existing and emerging compost markets in Alberta, market research was completed by the project team, primarily through targeted telephone surveying of provincial composters and potential/current end users of compost.

The project team contacted composters and potential/current end users of compost in each of the seven regions identified by Alberta Environment's Land Use Framework. This was done to assess potential regional differences and similarities within the composting industry.

This market research can not be considered exhaustive as it was limited by the project budget, and not all compost producers could be contacted. The goal of the research was to survey as many of the composters as possible within the project budget (26 were surveyed), while working to ensure geographical distribution.

The project budget also did not allow for actual quantitative compost market research to be completed; for accurate market quantification to be completed, 20% of end users must be surveyed. As such, the goal was to contact enough potential/current end users of compost within particular market segments to compare to quantitative market research done elsewhere. This approach allowed the project team to draw more educated conclusions pertaining to compost use potentials.

7.1 Market Research

7.1.1 Compost Facilities

A total of 26 public and private sector composting operations were selected from a list of facilities provided by Alberta Environment for inclusion in the survey. As shown in Exhibit 7-1, the survey revealed that only 22 of these organizations are still actively composting; the remainder have ceased operations for various reasons.

Four of the active facilities contacted are private operations, while the remainder are publicly operated. The largest of the operating facilities are located in the North and South Saskatchewan regions of the province. This is logical since these regions possess the largest cities (i.e. Calgary and Edmonton) and the largest number of urban centers (e.g. cities, towns, villages), and therefore, possess a greater number of composting facilities. Urban regions are typically the early and more extensive adopters of yard trimmings collection programs.

Eighty-six percent (86%) of the facilities contacted compost using the windrow composting technique and 77% compost L&YW feedstocks. Biosolids, food residuals and manure are the other most popular feedstocks being composted. Nine of the 22 facilities surveyed (41%) are composting multiple feedstocks.

The composting facilities that were contacted produce a wide range of compost volumes, from approximately 30 tonnes to 45,000 tonnes per annum of 'finished' product. Eighteen facilities provided compost production volume data, and together reported producing almost 111,000 tonnes of finished compost per annum.

Product quality control programs at the facilities, as indicated by product testing frequency, are highly variable. Seven composters stated that they do no testing at all, seven stated that they test once a year, and the rest reported they test on multiple occasions. Of the latter, only two are participating in the Compost Council of Canada's Compost Quality Assurance (CQA) program. This lack of extensive compost testing (quality control programs) is indicative of an industry which is not focused on producing and marketing compost (a product), but rather waste management (landfill avoidance).

EXHIBIT 7-1

COMPOSTING FACILITIES INCLUDED IN MARKET SURVEY

Active Facilities	Inactive Facilities
International Compost Ltd.	Whitecourt/WMF/Transfer Station
City of Calgary	Peace River Landfill/Eco Center
City of Leduc	City of Mayerthorpe/Highway 43 East Waste Com.
City of Airdrie	Canwest Compost & Soils Ltd.
Bowden Institute	
Roseburn Ranches Ltd. / ECO AG	
Roseridge Regional	
City of Red Deer	
Drayton Valley/Aspen Waste Mgt. Auth.	
Bow Valley Waste Management Commission	
Mountain View Reg. Waste	
Foothills Regional Services Commission	
Lethbridge Regional Waste Mgt. Services Commission	
Rocky Mountain Regional Solid Waste Authority	
City of Fort McMurray	
City of Camrose	
City of Medicine Hat	
Slave Lake/Lesser Slave Regional Landfill	
City of Edmonton	
Top Spray	
University of Alberta	
Thorlakson Feedyards	

7.1.2 End User Market Research

Information on Alberta business demographics was obtained from Business Lists For Sale LLC., and is summarized in Exhibit 7-2. Although there are limitations to the data, it outlines the number of businesses in Alberta that are traditionally end users of compost and related products, and provides an indicator of where primary markets might exist.

Relative to other jurisdictions, only a moderate concentration of potential end users and specifiers exist in Alberta, which is a reflection of Alberta's rural nature. Further, the majority of these entities are located in the North and South Saskatchewan regions of Alberta, influenced by their larger population bases.

EXHIBIT 7-2
BUSINESS DEMOGRAPHICS

Sector Description	Count
Agricultural Products	1
Greenhouses	255
Farms	170
Landscape Designers	29
Park Planning	3
Sod and Sodding Service	26
Landscape Contractors	352
Lawn & Garden Maintenance	106
Erosion Control	2
Environmental Reclamation	11
Landfills - Sanitary	7
Loam Suppliers	8
Nurseries	3
Lawn & Garden Equipt. & Retail Supplies	15
Garden Centers	59
Landscape Equipment Suppliers	22
Nurserymen	39
Golf Courses Public	242
Golf courses Private	18
Total	**1368**

A number of potential compost end users were contacted as part of the project, included 24 garden centers, 6 landscapers, and 5 wholesale nurseries. The project team primarily evaluated the garden center data, as 40% of the identified population were able to be surveyed during the project.

7.2 Market Research Findings

7.2.1 Compost Products

All of the composters surveyed are producing and distributing a traditional compost (i.e. soil amendment) product. Almost a quarter (23%) of the composters also manufacture blended topsoils containing compost, as well as other related horticultural soil blends. Two composters also identified that they are producing a turf topdressing (i.e. finely screened) grade of compost.

7.2.2 Compost Markets

Only nine of the composters surveyed actually market (sell) their compost, as the majority either use the product internally or give it away (it is common for regional solid waste authorities to give the product back to the communities generating the feedstock for their own internal usage).

Four of the 22 composting facilities (18%) sell compost in both bagged and bulk form. All the remaining facilities distribute compost in bulk form only. The bulk compost products are almost exclusively distributed (or sold) within a 50 km radius of the composting facility producing it.

Distribution and marketing of the compost is typically managed internally (and exclusively with those composters not selling their product). Half of the composters (four out of eight) market their own compost do so at least in part through external brokers or contractors. Of those composters contracting out their marketing, two produce only bulk compost and two market bulk and bagged compost.

Based on discussions with composters, the following 'traditional' markets for finished compost were identified within the Alberta marketplace as being the most popular:

- landscapers (8)
- use all internally (8)
- retail/residents (7)
- agriculture (2)
- erosion control (2)
- municipal/parks (2)
- landfill cover (1)
- topsoil blenders (1)

Internal usage by the municipally based composters is primarily on landscape and parks related projects. All of the uses listed above, aside from "use all internally" and "landfill cover", represent "paying" markets for compost.

The most popularly mentioned "emerging markets" (or applications) were:

- land reclamation (5)
- oil industry (3)
- erosion control (2)
- pelletization (1)
- green roofs (1)

Some additional creative uses for compost identified during surveying include use as a component to blended soils and soil mixes, as well as a 'land reclamation' mix, and use as an absorbent (solidifying) for drilling oil muds. Agriculture, selected reclamation uses, and landfill cover are the most likely uses for compost that is stable but not fully matured. Although the majority of composters are not marketing their product, it does appear that beneficial uses are generally being found for them and disposal of excess product has not been a major issue.

The sales price range for compost is between $4 and $80 per tonne (undelivered). However, more commonly, agricultural users are paying $4 to $15 per tonne (undelivered), while the landscape industry (ornamental end-use applications) is paying $14 to $30 per tonne (undelivered). Little additional data was provided on other market sector compost values.

Although little data was collected on this subject, it appears that the main factors affecting compost value are:

- the form in which it is sold (bagged and blended compost possesses a greater value than bulk and unblended compost),
- proximity to population bases (leads to greater innate demand); and
- marketing effort and creativity.

Certainly the value of compost is also affected by the availability of 'free' compost and the cost of competing products, such as topsoil and fertilizer.

7.2.3 Barriers to Compost Marketing

As part of the survey process, compost producers were asked to identify the barriers which are hindering the production and/or expanded usage of compost. The following is a summary of the responses which were received:

- the fertilizer and peat industries and the low prices of 'perceived' competing products (3)
- need more compost to sell / we 'run out' / need bigger facility – composters do not have enough feedstock to meet their current compost demand (3)
- reduce regulatory/permitting hurdles pertaining to facility 'start-ups' and expansions thereby allowing for an easier ability to manage organic by-products (2)
- reduce government procurement barriers and promote compost usage among government entities (2)
- difficult to enter reclamation market because of current revegetation regulations (2)
- poor quality compost is being brought on the market which negatively affects the opinion of the product (1)
- feedlots are selling cheap/low quality compost which negatively affects the opinion of the product (1)
- inexpensive topsoil negatively affects the perceived value of compost (1)
- lack of public understanding about compost and its value, requiring additional public education regarding the product (1)

- access to compost application equipment to assist in efficient and economic application (1)

A few composters were also concerned that too much compost would enter the marketplace without the appropriate market development and educational efforts being completed first. This is often a concern in regions where a smaller percentage of composters are actually marketing compost, and the rest are distributing it for free (or at a reduced price).

7.2.4 End Users

As mentioned earlier, the market data obtained from garden centers was the most heavily evaluated. Seventeen of the 24 garden centers (71%) are currently using or reselling compost in bulk or bagged form. Four garden centers purchase it only in bulk form, four purchase bulk and bagged compost, and nine purchase only bagged compost. The 71% penetration rate is excellent, but it should be understood that over half of the garden centers only carry compost in a bagged form. This is often the case, as many garden centers do not possess the space or equipment required to resell bulk products. Historically, garden centers carrying compost in bulk form, purchase greater volumes of it. Based on the garden centers providing numerical compost usage figures, the average garden center in Alberta which uses/resells compost, handles approximately 150 cubic yards per year of it or approximately 65 tonnes per year.

The garden centers provided an extensive list of barriers to greater compost usage:

- Do not carry bulk or soil products (7)
- Commercially produced compost is too expensive (5)
- They produce their own compost (2)
- Need compost to be packaged in attractive packaging (2)
- Must be low in odour (1)
- Would buy if available in area (1)
- Would buy if assured that it was thoroughly composted and weed free (1)
- Must educate marketplace about compost used as a fertilizer and the benefits of soil amending in general (1)

Compost is primarily used by (marketed to) the 'green' industry in Alberta between April and October, when temperatures are the most moderate. Typically, the highest demand occurs in April and May. Demand from June through September is relatively steady, but depending upon the market, there can be a secondary peak demand period in September.

Compost use will be affected by annual weather conditions, primarily temperature and precipitation. In areas where the ground will freeze later and thaws earlier (e.g., Calgary and Edmonton as opposed to Fort McMurray and Rainbow Lake) compost can be used for a longer period of time. Further, in areas where lower precipitation are expected (e.g., Lethbridge and Medicine Hat) compost may be promoted as a means to reduce irrigation requirements. If excess precipitation or drought occurs during the 'growing season', this will often negatively impact compost sales.

7.3 General Market Sizing

Since true quantitatively defendable market research was not able to be completed within the project budget, a general market sizing exercise was completed to provide an estimate of compost demand in Alberta using the best available current information. As such, RAA used quantitative data generated through a state-wide market assessment project completed for Iowa to determine estimated regional demand figures. If was felt by the project team that there was sufficient demographic similarities existed between Alberta and Iowa to allow for this comparison.

The Iowa Statewide Compost Market Assessment, which was completed in August, 1998, estimated a compost market size of 626,473 cubic yards (or 478,973 cubic meters) per annum for 2000. This estimate included primarily 'paying' markets for compost such as landscaping, golf courses, wholesale nurseries, organic agriculture, etc.), but did not include 'give-away' markets at the time, such as general agriculture, sod production and silviculture. Since other large, but low/no value markets were not included in the Iowa study, these figures would be considered conservative in nature. The assessment included the use of actual compost, as well as estimated replacement usage figures for other related products, such as peat, mulch, and topsoil. Iowa's population in 2000 was estimated at 3,496,303. Using the population and compost demand estimates and a simple extrapolation, a per capita demand for compost was established as 0.214 cubic yards (0.164 cubic meters) per year. Using this estimated per capita compost demand figure and regional Alberta population figures, the following regional compost demand estimates are provided in Exhibit 7-3.

EXHIBIT 7-3

ESTIMATED COMPOST MARKET DEMAND

Region	Population	Demand
North Saskatchewan Total	1,281,139	210,107 m^3/yr
South Saskatchewan Total	1,531,318	251,136 m^3/yr
Red Deer Total	274,784	45,065 m^3/yr
Lower Athabasca Total	131,786	22,613 m^3/yr
Upper Athabasca Total	119,039	19,522 m^3/yr
Lower Peace Total	41,291	6,772 m^3/yr
Upper Peace Total	116,946	19,179 m^3/yr
Total	**3,496,303**	**573,394 m^3/yr**

These estimates combined with the summary of existing production capacity and regional L&YW quantities prepared as part of this overall project, indicate that on a macro level there is a greater demand for compost products than what is being produced. As a micro level within each region, this discrepancy between production and demand will be affected by the presence of composting facilities that produce products from other feedstocks, and also by the presence of competing products. An example of the latter is the Edmonton area where there are significant volumes of screened topsoil and peat available in bulk.

7.4 Compost Market Expansion Suggestions

Data related to real or perceived barriers to compost production and end use can be extrapolated to create a list of suggestions/recommendations for expanding compost production and stimulating demand. Obviously, possessing a good understanding of the composting and 'end use' marketplace is also helpful.

The following suggestions for Alberta have been developed based on the findings from the compost producer and end user surveys completed during this project, as well as the Project Team's general experience.

- Infrastructural Assistance
    - Provide grant funding to offset the development costs involved with establishing new processing facilities, or expanding existing facilities. A key funding criteria should be compliance with the Standard for Composting Facilities in Alberta.
    - Provide grant funding to help offset the costs of equipment purchases for new composting facilities, and for equipment needed to expand the processing capacity of existing facilities.
    - Provide grant funding for compost producers and end users to purchase compost application equipment.
    - Implement regulations or policy tools on a province-wide basis that require or otherwise promote the diversion of additional volumes of organic feedstocks.
- Market Development Assistance
    - Consider the establishment of a fund that could offset the cost to farmers of applying compost on agricultural lands.
    - Conduct a review of government specifications, and amend them to allow/promote greater use of compost, where appropriate
    - Complete a review of provincial reclamation requirements and promote re-writing them to allow for increased use of compost, where appropriate
    - Develop materials and provide training related to compost market development and technical sales.
    - Develop and provide tools and training that outline how to sell compost against existing and low cost products.
    - Develop and implement a strategy to promote compost use with professional provincial end users and specifiers
    - Work with staff in Alberta Environmental and other provincial government departments (e.g. Agricultural and Rural Development) to promote compost as a tool for managing soil moisture retention and soil erosion.

- Regulatory Assistance
  - Finalize regulations, standards and guidelines pertaining to siting, operation and expansion of composting facilities with the goal of streamlining approval processes.
- Educational /Training Assistance
  - Work with NGO's to provide training courses on compost production and best practices to public and private facility operators and potential operators. Provide access to technical assistance.
  - Develop and provide information to compost producers on best practices and quality assurance/control programs needed to produce high quality (i.e. weed free and mature) compost products.
  - Promote and educate end user industries about the importance of purchasing high quality products, what constitutes quality products, how to understand quality data, and the differences between products.

8 Economic Instruments, Policy Options & Operational Tools

As part of a larger project to research and compile background information needed for the development of a provincial Leaf and Yard Waste (L&YW) Strategy, sonnevera international corp. undertook a review of L&YW economic, policy and operational options. The specific scope of work for this aspect of the project included identifying various economic instruments, policy options and operational tools that can be used to encourage L&YW diversion in Alberta and providing recommendations on the most appropriate options for implementation on a province-wide basis.

8.1 Economic Instruments

Economic instruments are monetary incentives or disincentives that act in a manner supportive of policy objectives. For instance, the intent of introducing a financial mechanism at disposal is to increase the cost of waste disposal to provide a financial incentive to increase diversion activities, such as composting and recycling. Disposal fees could be applied to all waste or can specifically target yard waste as a priority waste stream.

For optimal effect, funds collected as a result of economic instruments should be re-invested into activities supportive of policy objectives, such as alternative management options, education and enforcement. Economic instruments can also be applied evenly across the board for all waste, or differentiated for various waste types or levels of sorting.

8.1.1 Landfill Tax or Levy

Fees can be in the form of a tax or levy, applied by a country, province or municipality that increases the cost of landfill disposal. The tax or levy is typically based in units of currency per unit of weight or volume ($/tonne or yd3). The main purpose of landfill taxes or levies is to make landfill alternatives more attractive, and to guide waste producers to minimize waste, and to compost and recycle.

Taxes go to general government revenues and can be used for any government expenditures, which may or may not include waste management-related projects. Levies, on the other hand, typically play an important role in environmental protection, fostering environmentally sustainable use of resources and best practices in waste management. They can fund activities of regional waste management groups, industry waste reduction programs and education programs.

Some areas structure levies based on the magnitude of environmental risk posed by different wastes, and to accommodate regional differences.

Typically, lower levies are used to raise funds for waste diversion activities (e.g., diversion programs, grants and loans), while higher levies (> $30/tonne) are generally used to influence behaviour (Ontario Ministry of the Environment, 2010). This is presumably because the higher levies have a greater likelihood of changing behaviour. One of the concerns expressed over using landfill levies to fund infrastructure through grant programs is the perceived disadvantage of proactive jurisdictions who established programs prior to the levy being introduced. One way to provide a level playing field in this regard is to return the levy to regions based on their diversion performance, thereby funding results rather than plans.

Other key findings from the Ontario Ministry of the Environment (2010) on levy research include:

- Disposal levies work best when accompanied by other supporting measures, such as financial incentives, bans and regulatory instruments.
- Disposal levies are most effective at driving behaviour change when they operate on a "polluter pay" basis and the fee is paid by the waste generator.
- To increase diversion from disposal, additional waste diversion capacity is required. If alternatives do not exist, disposal rates may not change.
- A weight-based levy is most likely to be effective at changing behaviour, when compared to other levy types (e.g., fixed fee or volume based).
- Modest landfill charges can generate large revenues and still be insufficient to affect behaviour change.
- The effectiveness of a levy depends more on the size of its relative increase (e.g., % increase) than the absolute value of change.

8.1.1.1 Examples

Manitoba – Starting on July 1, 2009, the Waste Reduction and Recycling Support (WRARS) Levy of $10.00/tonne was introduced on waste disposed at Manitoba landfills. Eighty percent of the revenue collected in the WRARS Fund from this levy is rebated to municipalities to further promote recycling in Manitoba, with the remainder of the funding to be used for increased support for provincial e-waste and hazardous waste collection programs across the province. The WRARS Fund is managed by Green Manitoba, a special operating agency of the Province of Manitoba.

This levy is being introduced in three phases:

- Phase 1 – As of July 1, 2009, all Class 1 landfills receiving more than 30,000 tonnes of waste per year are required to pay the $10/tonne WRARS Levy on waste disposed.
- Phase 2 – As of January 1, 2010, the remaining Class 1 landfill operators are required to pay the WRARS Levy.
- Phase 3 – As of January 1, 2011, Class 2 and Class 3 landfill operators will pay the WRARS Levy.

New Jersey – The Recycling Enhancement Act (State of New Jersey, 2008) reestablished a source of funding for recycling in New Jersey (the previous recycling tax expired in 1996) by mandating a $3/ton tax on solid waste accepted for disposal or transfer at in-state solid waste facilities effective April 1, 2008. It is estimated that this fee amounts to $34 million annually. Funds are allocated for the following purposes:

- 60% - municipal and county recycling grants.
- 25% - county preparation and implementation of solid waste management plans.
- 5% - county public recycling information and education programs.
- 5% - New Jersey Department of Environmental Protection grants to institutions or higher education to conduct research in recycling.

- 5% - New Jersey Department of Environmental Protection recycling program planning and administrative expenses associated with the program.

Ontario – As part of the Waste Diversion Act, 2002 review, *From Waste to Worth: The Role of Waste Diversion in the Green Economy, A Minister's Report on the Review of Ontario's Waste Diversion Act, 2002* presents proposed changes to Ontario's waste diversion framework. In order to support producer responsibility, implementation of "a disposal levy to narrow the gap between the cost of diversion and disposal, and shift behaviour toward greater diversion" (Ontario Ministry of Environment, 2009) is presented. To complement this, levy revenues will be used to support waste diversion efforts. Public review of this document took place from October 28, 2009 to February 1, 2010.

Quebec – On June 23, 2006, Quebec started collecting a $10/tonne levy on landfilled and incinerated waste. Roughly $50 million is collected each year. Eighty-five percent of levy revenue is distributed back to municipalities who have adopted a regional residual management plan. During the first two years, subsidies were shared on a per-habitant basis; now they are gradually given according to the municipal performance with regards to reducing landfilling and incineration.

The draft *Charges Payable for the Disposal of Residual Materials Regulation* requests adding $9.50/tonne to the current levy (Gazette Officielle Du Quebec, 2009). The additional $9.50/tonne will be in place from April 1, 2010 to March 31, 2015, and will provide municipalities with funding to assist building organics processing infrastructure. Public hearings took place between November 25, 2009 and January 24, 2010 regarding this Regulation.

California - In California, Assembly Bill 939 and Public Resources Code requires a per-ton fee to be collected for the Integrated Waste Management Fund.

As of February 2010, this fee is $1.40/ton, however Senate Bill 25, currently a Senate priority bill for 2009-2010 that will be heard by August 2010, is requesting an increase to $2.13/ton on or after January 1, 2012 (Padilla, 2008).

San Jose, CA – In 1987, San Jose established a business tax for landfills to better reflect the type of business activity at the landfill. Rather than charging the operators on the basis of the number of employees (as it did with most other businesses), the city decided to charge landfills in San Jose on the basis of the amount of waste disposed in landfills. The city initially set the charge at $2/yd^3, measured by annual aerial surveys. After problems the first year with the volumetric measurement, the city changed the tax basis to $3/ton and required landfills to provide scales. In 1992, the tax was revised to its current rate of $13/ton at disposal sites. At this time, cover material is exempt from this tax that generates approximately $13 million per year (City of San Jose, 2009).

The Disposal Facility Tax raises money for the city General Fund and is structured to provide an incentive to the landfill operators to maximize their waste diversion on-site. All materials recycled or beneficially used are deducted from the tax obligation of the landfills to the city.

Wisconsin – Effective July 1, 2009, the Environmental Repair Fund Fee rose from $1.60 to $5.70/ton and the Recycling Fee increased from $4/ton to $7/ton beginning October 1, 2009. Combined, the state's landfill tax increased to $12.70/ton in 2009 from $5.60/ton previously.

New South Wales (Australia) – The Waste and Environment Levy applies to waste generated in the Sydney Metropolitan Area (SMA), the Extended Regulated Area (ERA) and the Regional Regulated Area (RRA) for waste facilities anywhere in New South Wales. The levy also applies to waste generated outside the SMA and ERA that is disposed at facilities in the SMA and ERA. The 2009/10 levy rates are set at $58.80/tonne in the SMA, $52.40/tonne in the ERA and $10/tonne in the RRA. Additionally, the levy on trackable liquid waste is $55.70.

South Australia (Australia) - The 2008/2009 levy is $24.20/tonne for metro waste and $12.10/tonne for non-metro waste while the state wide levy for liquid waste is $10.10/tonne. Fifty percent of the levy funds are directed to the Waste to Resources Fund for use in programs to improve waste management and waste minimization in South Australia.

Victoria **(Australia)** – For 2008-2009 the landfill levy rates in the metro and provincial areas are $9/tonne for municipal waste and $15/tonne for industrial waste. In rural areas, municipal waste is $7/tonne while industrial waste is $13/tonne.

Since the introduction of the landfill levy system, money generated has significantly contributed to improve waste management throughout Victoria. A variety of programs have been initiated, including the following:

- Substantial upgrading of curbside recycling systems.
- Expanding household chemical collection programs.
- Development and promotion of markets for recycled materials.
- Major studies into waste minimization, handling and disposal, organics recycling and litter control community support projects.

Western Australia (Australia) – In 1998, the levy on waste sent to landfill in the Metropolitan area was $3/tonne for putrescible waste and $1/tonne for inert waste. As of July 1, 2009, the landfill levy increased to $8/tonne for putrescible waste and $3/m^3 for inert waste. On May 2009, the State Budget announcement proposed the levy to increase for putrescible waste to $28/tonne and inert waste to $12/m^3 as of July 1, 2009. Due to negative response, the landfill levy increase was delayed until January 2010. Currently levy funds assist strategic waste management activities.

Denmark - In 1987, a landfill tax of €5/tonne for waste being incinerated or landfilled was introduced. Now the landfill tax is €50/tonne for landfilling and €44/ tonne for incineration.

Ireland – Under Landfill Regulations (2001), a tax is charged per tonne of waste disposed of at authorized landfills. From 2002 – 2008, the tax was €15/tonne; effective July 2008, the tax increased to €20/tonne ($36/tonne Canadian).

New Zealand – Effective July 1, 2009, a $10/tonne levy was introduced on all waste sent to the landfill as per the Waste Minimization Act 2008. The levy is anticipated to generate $31 million a year for waste minimization improvements (New Zealand Ministry of the Environment, 2009). Half of the revenue generated by the levy goes to territorial authorities, based on population size. The funds must be spent on promoting or achieving waste minimization activities set out in their waste management and minimization plans. A waste minimization fund holds the remaining levy money, minus administration costs, to fund waste minimization projects.

Projects are assessed according to a set of criteria established in consultation with the Waste Advisory Board.

Netherlands - In 1995, a landfill tax of €13/tonne was introduced. This tax has since been raised to €107/tonne ($150/tonne Canadian) for 35 waste categories. In 2010, this was the highest landfill tax rate in the European Union.

Ontario Ministry of the Environment (2010) research of the Netherlands program shows that, following the introduction of the levy, from 1995-2003, the amount landfilled decreased by approximately two thirds. In 1995, 35% of municipal waste and 43% of ICI waste was landfilled; by 2006, 6% of municipal waste and 11% of ICI waste was landfilled. The amount incinerated increased by about 75% and the amount recycled increased by about 30%.

United Kingdom - A landfill tax based on waste disposal tonnage aims to encourage waste producers to produce less waste and recover more value from waste by recycling or composting. This tax, effective October 1, 1996, applies to all waste disposed at licensed landfill sites unless the waste is an exempt material.

Two rates exist: the tax on inert or inactive waste is £2.50/tonne, while the tax on standard waste is £40/ tonne ($62/tonne Canadian) for 2009/2010. The standard waste tax will increase by £8/ tonne/ year on April 1st each year until 2013.

Ontario Ministry of the Environment (2010) research of the United Kingdom's program shows that this tax did not impact waste generation, but was successful at improving landfill diversion as recycling increased slightly from 7% to 11%. Further, this tax failed to provide significant incentive for alternative methods of waste management; landfilling remains the most economical disposal option.

Other - Taxes and levies on waste material sent to landfill have become common place around the world. Austria, Czech Republic, Finland, France, Israel and Sweden also have landfill taxes/levies in place.

8.1.1.2 Effectiveness

It is difficult to establish the impact of landfill taxes/levies on waste diversion from landfills, as other instruments are typically introduced at the same time (e.g., landfill bans). On the other hand, levies in the long term do assist with waste reduction and diversion, as they help fund these programs.

Evidence from other jurisdictions suggests that there is no significant correlation between taxes and levies and reduction in waste disposal unless the tax/levy is substantial (e.g., $50/tonne and higher). Both in Australia and overseas, experience and predictions have shown that a lower fee may achieve small gains in terms of resource recovery but will not lead to significant changes in the way waste is managed (Hyder Consulting, 2007).

The advantages and disadvantages of this approach are summarized in Exhibit 8-1.

EXHIBIT 8-1

LANDFILL TAX/LEVY ADVANTAGES AND DISADVANTAGES

Advantages	Disadvantages
• Provide economic incentive to minimize waste generation and increase diversion activities such as recycling and composting. • Capture both public and private sector generators. • Provide funding mechanism for waste infrastructure projects, enforcement and education programs. • Non- prescriptive approach that provides flexibility to meet local circumstances.	• May encounter government resistance to imposing more 'tax'. • Encourage shipping of waste to other jurisdictions where taxes/levies are not in place, if this practice is economically advantageous (e.g., shipping cost less than difference in disposal cost). Similarly, if alternate waste disposal options exist and are readily available, they may be utilized instead of waste reduction. • Costs may simply be passed through by generators to their customers, instead of resulting in behaviour change.

8.1.2 Differential Tipping Fees

Differential tipping fees are charged at waste processing and disposal facilities. These fees vary depending on the type of material disposed and are typically used as an incentive for source separation of materials. For instance, materials separated for diversion, such as yard waste that can be composted, would be charged a lower rate than general unseparated garbage. An alternate approach that encourages diversion prior to the waste management facility would impose a higher rate on waste that contains divertable materials.

8.1.2.1 Examples

Bow Valley Regional Waste Management Commission, AB – Effective March 15, 2009, mixed waste at the Class III Francis Cooke Regional Landfill is charged $75/tonne for sorted waste, $135/tonne for unsorted waste (if yard waste is in garbage), while separated green wood (scrub, brush and stumps) and yard and garden waste is $40/tonne.

Capital Regional District, BC – Effective January 2, 2010, Hartland Landfill's tipping fee is $100/tonne for the disposal of general refuse (including wood waste, mattress/box springs and branches/stumps over 3" in diameter). Separated yard and garden waste is charged $55/tonne for chipping and recycling.

Comox Valley Regional District, BC – The current tipping fee for household garbage within the regional district is $65/tonne whereas loads containing recyclables are charged $150/tonne. Household waste from outside the district is $195/tonne and $350/tonne if loads contain recyclables.

Fundy Region Solid Waste Commission, NB – At the Crane Mountain Landfill, municipal solid waste is $108/tonne, while compostable material (e.g., yard, food and paper waste) is $28/tonne. Compostable material was $35/tonne in 2009 and decreased to $28/tonne as of January 1, 2010 to encourage separation and to complement a fee of $28/tonne for sorted C&D materials.

Ottawa, ON – As of February 1, 2009, the Trail Waste Facility tipping fee for mixed waste is $90/tonne, while residential brush (under 4" in diameter) and yard waste is free; and commercial brush (under 4" in diameter) and yard waste is $45/tonne. For brush over 4" in diameter, a $90/tonne fee is charged.

Regional District of Kootenay Boundary, BC –Separated yard and garden waste are charged $2 per load, while woody materials (branches and clean wood waste) are $30/tonne and regular garbage is $80/tonne. Yard and garden waste is banned from landfill disposal. Any garbage loads containing banned materials are charged five times the landfill rate, which equates to $400/tonne.

San Diego, CA – Self-haul tonnage disposal fees effective July 1, 2009 at the Miramar Landfill are shown in Exhibit 8-2.

EXHIBIT 8-2

CITY OF SAN DIEGO DISPOSAL FEES

Weighed Loads	Material Type Tonnage Fees	
	Refuse*	Clean Green/Wood
Resident, less than 2 tons	$40	$0
Resident, 2 tons or more	$48	$0
Business	$48	$22
Non-city waste	$54	$25

*Includes $10 recycling fee, $8 refuse collector business tax, or franchise fee as applicable

Sudbury, ON – Effective January 1st 2010, the tipping fee for household waste is $63/tonne for more than 100 kg. Separated leaf and yard trimmings are taken at no charge.

8.1.2.2 Effectiveness

Particularly if the differential in the rates are significant, this approach is likely to result in an overall reduction in the amount of non-sorted waste entering landfills. However, no definitive results quantifying this reduction were found.

The advantages of this approach are summarized in Exhibit 8-3.

EXHIBIT 8-3

DIFFERENTIAL TIPPING FEES ADVANTAGES

Advantages
• Source separation of materials can be encouraged by offering a monetary incentive.
• Equalizes the overall costs of operating a waste management system and rationalizes the hauling costs for site users who must travel longer distances to a facility which facilitates separate processing of specific materials.

8.2 Policy Options

Policy options include practices and processes with the goal to minimize waste, such as mandated standards and regulations.

8.2.1 Mandated Standards and Regulations

Various regulatory mechanisms have been implemented by the European Union, and at US state levels, setting the stage for the development of diversion programs in order to meet goals. One option is to mandate a diversion goal with a penalty to stress the importance of achieving the target. Another option is to set the ground work for waste management plans and give guidance on how to complete plans to achieve the goal.

8.2.1.1 Examples

European Union - The European Union Landfill Directive (1999/31/EC]) (Official Journal of the European Union, 1999) was adopted on July 16, 1999. The Directive aims to improve standards of landfilling across Europe, through setting specific requirements for the design, operation and aftercare of landfills, and for the types of waste that can be accepted in landfills. The deadline for implementation of the legislation by Member States was July 16, 2001.

Successive targets are outlined in the Directive for reducing biodegradable municipal waste (by weight) being landfilled. Based on the implementation deadline, biodegradable municipal waste must be reduced to:

- 75% of that produced in 1995 by 2006 (5 years after implementation)
- 50% of that produced in 1995 by 2009 (8 years after implementation)
- 35% of that produced in 1995 by 2016 (15 years after implementation)

Thirteen initial European Member States (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain and Sweden) have adopted the Directive with its original targets. Meanwhile, Greece and the United Kingdom requested postponement of the targets by four years. Their biodegradable municipal waste must be reduced to 75% (by weight) of the 1995 baseline by 2010, 50% by 2013 and 35% by 2020.

California – Assembly Bill 939 (CalRecycle, 2010a), part of the Integrated Waste Management Board Act of 1989, mandated 25% diversion by 1995 and 50% diversion by 2000, and gave the California Department of Resources Recycling and Recovery (CalRecycle), formerly the California Integrated Waste Management Board, the option to impose administrative civil penalties of up to $10,000 per day for continued failure to comply. Through the Public Resources Code, cities and counties are given the power to collect fees sufficient to pay the costs of preparing, adopting, and implementing a countywide integrated waste management plan. Additionally, CalRecycle is allowed to collect fees for an Integrated Waste Management Fund that assists with subsidizing CalRecycle programs as discussed in Section 2.1.1.

The estimated statewide diversion rate for the period from 1989 through 2008 is shown in Exhibit 8-4.

EXHIBIT 8-4

ESTIMATED CALIFORNIA DIVERSION RATES (CALRECYCLE, 2010B)

Year	Estimated Statewide Diversion Rate (% of generation)[1]	Year	Estimated Statewide Diversion Rate (% of generation)[1]
1989	10%	1999	37%
1990	17%	2000	42%
1991	20%	2001	44%
1992	21%	2002	48%
1993	24%	2003	47%
1994	25%	2004	48%
1995	28%	2005	52%
1996	31%	2006	54%
1997	32%	2007	58%[2]/54%[3] (5.8 lbs/person/day disposal rate)
1998	33%	2008	59%[3] (5.1 lbs/person/day disposal rate)

Notes:

1. For 2007 and subsequent years, CalRecycle compares reported disposal tons to population to calculate per capita disposal expressed in pounds/person/day.

2. Old measurement methodology.

3. New measurement methodology estimated diversion rate equivalent.

Assembly Bill 737 (Chesbro, 2009), introduced February 26, 2009, is currently a Senate priority bill for 2009-2010 and will be heard by August 2010. This bill would increase the state diversion mandate to 75% by 2020, require businesses to arrange for recycling services and require local jurisdictions, by January 1, 2011, to adopt a mandatory commercial recycling ordinance.

Senate Bill 25 (Padilla, 2008), introduced December 1, 2008, is also a Senate priority bill for 2009-2010 and will be heard by August 2010. This bill would increase the state diversion mandate to 60% on or after January 1, 2015 and to 75% on or after January 1, 2020.

8.2.1.2 Effectiveness

This type of instrument requires consistent and significant enforcement. It does not work unless the government who enacts the legislation is committed to enforcement, and also has the resources to enforce it effectively, as shown in the California statewide diversion rates above.

Considerable measurement and tracking is required to determine if goals are met, and to take corrective action if they are not.

A means of funding is also necessary for diversion programs to be developed as a result of regulated goals.

8.3 Operational Tools

This group of tools includes initiatives that promote waste diversion during the operational phase, through limits on disposal, or specific material handling or facility management requirements.

8.3.1 Disposal Bans

Disposal bans restrict materials from being handled through disposal facilities such as landfills and incinerators. A waste management facility may still receive material for processing and diversion.

Landfill disposal bans are typically implemented at the provincial/state, regional or municipal level ensuring that specified materials (e.g., yard waste) are diverted from disposal. This tool assists with significant landfill diversion and helps to meet waste diversion goals.

Bans are most effective as a complementary tool, where they are part of a coordinated approach that combines a suite of policies and mechanisms.

8.3.1.1 Examples

Capital Regional District, BC – Yard and garden waste has been banned at the Hartland Landfill since June 1, 2006.

Metro Vancouver, BC – To assist with the Zero Waste Challenge (70 per cent diversion by 2015), as of January 1, 2008, residential and business yard trimmings and green waste was banned from Metro Vancouver disposal facilities.

Regional District of Nanaimo, BC – Solid Waste Management Regulation Bylaw No. 1531, 2007, mandates that commercial organic waste is prohibited from landfill disposal.

Nova Scotia – Effective June 1, 1996, leaf and yard waste was banned from landfill disposal.

Ontario – To complement the disposal levy discussed in Section 2.1.1, banning designated materials from disposal is also proposed in the From Waste to Worth: The Role of Waste Diversion in the Green Economy – Minister's Report on the Waste Diversion Act 2002 Review.

Quebec – Once province-wide organics infrastructure is in place, the province will implement organics bans. As discussed in Section 2.1.1, the province has proposed a $9.50/tonne levy increase, from 2010-2015, to assist with paying for organics processing infrastructure.

Delaware – A condition of the permit renewal for the Cherry Island Landfill (SW-06/01) was to implement a yard waste ban (State of Delaware, 2006). The permit was renewed, but the ban was delayed until January 1, 2007 to give a reasonable transition period. Enforcement of this ban started on January 24, 2008. The remaining two landfills, Sandtown and Jones Crossroad, await permit renewals in 2010. Like Cherry Island Landfill they will be given a transition period to implement yard waste bans (Miller, 2010). It is estimated that the yard waste ban at all three landfills will keep 80,000 tons a year of organic material out of the landfill (O'Mara, 2010).

Sonoma County, CA - Prohibits yard and woody debris from disposal.

Wisconsin – The Wisconsin Solid Waste Reduction, Recovery and Recycling Law (Subchapter II, 287.07 (2)) banned yard waste from landfills as of January 3, 1993. Yard waste, including grass clippings, leaves, yard and garden debris and brush under 6", can go to an approved compost facility or be incinerated with energy recovery. Brush may be burned at licensed wood burning facilities if reasonable alternatives are not available.

Other States – Between 1989 and 1998, a total of 23 states (South Dakota, Nebraska, Minnesota, Iowa, Missouri, Illinois, Indiana, Michigan, Ohio, Wisconsin, Pennsylvania, West Virginia, North Carolina, South Carolina, Georgia, Florida, Hawaii, New Hampshire, Connecticut, New Jersey, Massachusetts, Rhode Island, Maryland) and the District of Columbia banned the disposal of yard trimmings in their landfills, with most occurring in the early 1990s. Florida "instituted a ban on yard wastes from lined landfills in 1992 and has noted yard waste volumes being recycled or composted have doubled" (Ficks, 2002).

Update: Several states, including Michigan (Senate Bill 864) and Georgia (House Bill 1059), are currently considering a repeal of the yard trimmings ban under the auspices of bioreactors generating renewable, green energy in the form of landfill gas.

Denmark – In 1997 a ban for landfilling combustible wastes suitable for incineration took effect.

8.3.1.2 Effectiveness

Disposal bans result in significant yard waste diversion. For example, it is estimated that Delaware's Cherry Island Landfill diverted as much as 50,000 tons of yard waste in 2009 as a result of the ban (The Recycling Public Advisory Council, 2009). This ban effectively diverts yard waste from the landfill, while fostering local jobs and businesses.

The advantages and disadvantages of this approach are summarized in Exhibit 8-5.

EXHIBIT 8-5

DISPOSAL BAN ADVANTAGES AND DISADVANTAGES

Advantages	Disadvantages
• Reduces the amount of material transported to landfill, thereby reducing the need for new landfills and other disposal facilities.	• Prior to implementing bans, markets and handling facilities for banned materials must be available.
• Reduces the quantity of material required to be handled by municipalities and counties.	• Precludes counting greenhouse gas offsets from bans.
• Effective diversion of material from disposal.	• Need strong public education program.
• Supports the recycling industry and can lead to economic development.	• Waste may move to other jurisdictions.
	• Potential for increase in illegal dumping.
• Reduces methane gas production resulting from biodegradation of yard waste in a landfill.	• Strong enforcement is required.
• Typically little or no opposition.	• Loss of tipping fees requires budget considerations.
• Easy to introduce and administer.	
• Easily measured.	

8.3.2 Mandatory Source Separation/Recycling

Mandatory recycling requires, by law, that residents and/or businesses separate waste so that recyclable materials are recovered for composting or recycling, rather than being disposed.

Sorting various waste materials at the generation point assists with simplifying processing and making recycling more efficient.

8.3.2.1 Examples

Edson, AB – Through the Waste Management Bylaw No. 1858 (Town of Edson, 1998) lawn clippings and garden waste are excluded from waste collection. If these materials are found in the garbage they are left behind with a green sticker that states that these materials should be taken to the Recycling Depot, where they are collected for composting.

Olds, AB – Bylaw 2005-21 (Town of Olds, 2005) enables collection crews to reject garbage that contains recyclable or organic material.

Owen Sound, ON – Bylaw Waste Management 2005 – 151 – Waste Management Schedule F Prohibited Waste Materials states that yard waste (grass, leaves and branches) "shall not be placed out for disposal as Disposable Waste at the curbside or at the Transfer Station but may be disposed of at the Leaf and Yard Waste Composting Site or through appropriate private composting programs" (City of Owen Sound, 2005).

Regional District of Kootenay Boundary, BC – Effective September 1, 2001, it is illegal to have yard and garden debris in garbage. Residential yard and garden waste is accepted for composting at Regional District landfills for $2/load while woody material (branches, clean wood waste) is $30/tonne.

Toronto, ON – The City of Toronto has an aggressive goal to divert 100% of waste from the landfill by 2012. In order to work towards this goal, The Toronto Municipal Code Waste Collection, Residential Properties, Chapter 844-8, states that grass clippings and sod will not be collected by the city and that the owners are not allowed to "set out prohibited waste for collection by the City, either on its own or mixed with any waste with respect to which the City provides services" (City of Toronto, 2009).

Alameda County, CA – In order to meet the 1990 self-imposed goal of 75% diversion by the end of 2010, disposal must be significantly reduced from current levels. Based on Ordinance 2008-01, residential and ICI plant debris (grass, leaves, shrubbery, vines, tree branches and trimmings that are normally associated with the care and maintenance of gardens and landscaping, except for palm trees and any parts of palm trees) must be separated and recycled. Even though this Ordinance has been in place since January 2009 "a surcharge equivalent to 50% of the normal tipping fee, not to exceed $100 for the first occurrence, $200 for the second occurrence within one year and $500 for each additional occurrence within one year" for mixed loads became effective January 1, 2010 (Alameda County, 2009).

Montgomery County, MD – To complement the State of Maryland's disposal ban on separately collected loads of yard waste, Montgomery County requires the recycling of yard waste, along with other recyclable materials. Yard trim "grass and leaves must be placed in containers or large paper bags labeled 'yard trim' and containers or bags must not exceed 45 gallons in volume and 60 pounds by weight. Brush must not exceed 4" in diameter and 6 feet in length, and must be placed in labeled containers or paper bags or tied in bundles no greater than 36 inches in diameter. Plastic bags must not be used to contain yard trim or Christmas trees. Christmas trees must have all ornaments and metal objects removed" (Montgomery County, 2005).

New Jersey – Passed in April 1987, the New Jersey Statewide Mandatory Source Separation and Recycling Act (N.J.S.A. 13:1E-99.11 et seq.) required counties to mandate recycling of at least three designated recyclable materials, in addition to leaves. Bergen, Hudson and Morris Counties have grass and tree parts/yard trimmings on their designated recyclables list.

Oregon – State goals for 2009 include "recovery from the general solid waste stream shall be at least 50 percent" and that for 2009 and "subsequent years, that there be no annual increase in per capita municipal solid waste generation." These goals require municipal, county or metropolitan service districts to create yard debris (grass clippings, leaves, hedge trimmings and similar vegetative waste generated from residential property or landscaping activities, but does not include stumps or similar bulky wood materials) programs, including the establishment of "An effective residential yard debris collection and composting program that includes the promotion of home composting of yard debris, and that also either: (A) Monthly or more frequent on-route collection of yard debris from residences for production of compost or other marketable products; or (B) A system of yard debris collection depots conveniently located and open to the public at least once a week" (State of Oregon, 2009).

Santa Clarita, CA – Yard trimmings (leaves, grass clippings, weeds, twigs, shrubbery and tree trimmings) composting is mandatory for residents. Each household has a 64 gallon gray organics container that is set out at the curb the same day as garbage collection.

Seattle, WA – Yard waste debris has been prohibited from residential garbage since 1989. City of Seattle Ordinance #121372, effective January 1, 2005, prohibits yard waste from business and self-haul garbage in significant amounts (more than 10% by volume of container). Administrative Rule SPU-DR-01-04, "Prohibition of Recyclables in Garbage" details how the City ordinance is to be carried out.

Before implementing this requirement, a three step phase-in program took place:

1) Outreach and Education in 2004 - Seattle Public Utilities conducted an educational outreach program through direct mail to residents and businesses. A new, automated (206) RECYCLE phone number was established to answer basic questions about the requirements for single-family residents, apartment dwellers, businesses and self-haul customers to the City's Recycling and Disposal Stations.

2) Educational Tagging in 2005 - Contractors and inspectors placed educational notice tags on garbage cans and dumpsters which contained significant amounts of recyclables. Transfer station customers received educational notices.

3) Enforcement in 2006 - Effective January 1, 2006, the City of Seattle began enforcing the mandatory recycling ordinance 'with consequences'.

- Single-family Residents - The City's contractors do not pick up garbage cans that have significant amounts of yard trimmings. A tag is left on the can instructing customers to separate out the yard trimmings and place the container out at the curb for collection the following week.

- Apartment Owners or Property Managers - City inspectors mail to the garbage account holder up to two warning notices before a $50 surcharge is added to the apartment building's garbage bill.

- Business Owners or Property Managers - City inspectors mail to the garbage account holder up to two warning notices before a $50 fine is imposed.
- Recycling and Disposal Station Customers -Self-haul customers are asked to separate out recyclable paper and cardboard as well as yard debris from their loads and not to dispose of such material in the garbage pit.

8.3.2.2 Effectiveness

No results that quantify effectiveness of mandatory source separation/recycling alone were obtained.

The advantages and disadvantages of this approach are summarized in Exhibit 8-6.

EXHIBIT 8-6

MANDATORY SOURCE SEPARATION/RECYCLING ADVANTAGES AND DISADVANTAGES

Advantages	Disadvantages
• Promotes the removal of designated materials from the waste stream, thereby decreasing waste being disposed. • Enables the source recycler to receive economic benefits by not disposing of recyclable materials in the waste stream; effective with residential user pay program. • Fosters free market independent of the waste collection and disposal system. • Facilitates more accurate waste tracking, as recyclables are kept separate from solid waste. • Can foster competition among recycling businesses, thereby keeping costs low and quality of service high. • Encourages a thought process among each individual source recycler that waste disposal is everyone's responsibility, which can foster further source reduction and recycling activities at home, work and school.	• Requires continuous enforcement.

8.3.3 Mechanisms Linked to Permitting

In order to receive a facility permit, the disposal facility (e.g., landfill) agrees to diversion conditions such as yard waste bans or working towards waste reduction goals.

8.3.3.1 Examples

Delaware – A condition of the SW-06/01 permit renewal for the Cherry Island Landfill was to implement a yard waste ban (State of Delaware, 2006). The remaining two landfills, Sandtown and Jones Crossroad, await permit renewals in 2010. Like Cherry Island Landfill, they must implement yard waste bans.

San Jose, CA – San Jose has four landfills operating within its borders: Zanker Road Landfill (independent), Newby Island Landfill (BFI/Allied), Kirby Canyon (WM) and Guadalupe Mines Landfill (previously independent, now WM). Solid waste facility permits written for three of the four landfills in the 1980s required them to assist in meeting the city's waste reduction goals as a condition of their permits. The fourth facility had grandfathered permits, but was required under its disposal agreement with the city to help meet the city's waste reduction goals.

Permit conditions contained in one or more of the permits included:

- Source separation discounts. Landfills were required to offer lower rates to generators for clean, source-separated materials to enable landfills to more easily recycle those materials.
- Provide areas for salvaging, drop-off recycling and composting on site.
- Distribute public information on recycling.
- Assist the city's solid waste program to meet its waste reduction goals.

Conditions included in the 30-year disposal agreement for the Newby Island Landfill are:

- Provide a recycling center at least 7.5 acres in size.
- Use compost as cover material.
- Allow the city to unilaterally decrease its put-or-pay commitments to the landfill by 25 percent in response to recycling and waste reduction initiatives.
- Provides a process for negotiating even lower waste flow commitments by mutual consent.

Zanker Road Landfill embraced permit condition goals and researched alternative technologies to implement at their facility. Zanker's permits restrict it to receive only nonputrescible wastes. Over the last five years, Zanker diverted 94% of all wastes entering its facility.

8.3.3.2 Effectiveness

Approaches linked to permitting may divert materials from disposal. However, no definitive results to prove this were obtained.

The advantages and disadvantages of this approach are summarized in Exhibit 8-7.

EXHIBIT 8-7

PERMITTING MECHANISM ADVANTAGES AND DISADVANTAGES

Advantages	Disadvantages
• An approach linked to permits is congruent with existing business practices, therefore not requiring significant changes. As a result, this approach is relatively quick to implement and achieve results, as long as alternative facilities and infrastructure are in place to recycle the diverted material. • This approach uses market forces to achieve policy goals. Permitting mechanisms have the potential to recognize and reward good performers, while internalizing costs to poor ones. At the same time, this approach may not influence design if fees are just passed on to customers.	• Additional administrative requirements for contractors and enforcement responsibilities for government are a necessary consequence of implementing a permitting mechanism.

9 Financial Impacts of Carbon Credits on L&YW Composting Facilities in Alberta

This review of the impact of carbon credit programs on leaf and yard waste (L&YW) composting facilities has been prepared as part of a larger project to research and compile background information needed for the development of a provincial L&YW Diversion Strategy. The Project Team estimated the total amount of L&YW in Alberta to be approximately 500,000 tonnes per year (wet basis). The specific scope of work for this aspect of the project included calculating greenhouse gas (GHG) offset credits that could be expected from diverting this amount of L&YW to composting facilities, identifying the order-of magnitude costs associated with quantifying and verifying emission reductions and registering/trading offset credits, and summarizing historical values for offset credits in the marketplace. This work is intended to provide background on GHG protocols to the L&YW Diversion Technical Committee, and assist them in further understanding how policy tools might financially affect GHG credit calculations.

9.1 Background

The emission of greenhouse gases (GHGs) is an important concern as they are the main cause of climate change. In 2007, Canada emitted approximately 747 megatonnes of carbon dioxide equivalence (CO_2e), which is about 22.6 tonnes per capita (Environment Canada 2009). About 21 megatonnes of CO_2e per year is associated with municipal solid waste management in Canada (Environment Canada 2009).

The Climate Change and Emissions Management Act (Alberta, 2003) was promulgated to reduce the emission of greenhouse gases (GHG) in Alberta. Under this Act, the Specified Gas Emitters Regulation (Alberta, 2007) established the framework for GHG emission offsets. To assist with estimating GHG emission offsets from composting operations in Alberta, the guidance document entitled 'Quantification Protocol for Aerobic Composting Projects' (here after called the Protocol) was written to ensure standard approaches are used (Alberta Environment 2008). The Protocol was used to calculate the offset credits presented in this report.

The Protocol uses an adjusted baseline approach. In the case of composting, the baseline is landfilling. Therefore, the amount of offset GHG for L&YW was determined by equation (1), where the baseline and project are landfilling and composting, respectively:

$$\text{Emissions Reduction (Offset)} = \text{Emissions}_{\text{landfill}} - \text{Emissions}_{\text{composting}} \qquad [1]$$

9.2 GHG Offset Calculations

The Protocol analyzed and compared the potential GHG sources and sinks for landfilling and composting facilities (Alberta Environment, 2009). This resulted in the identification of five GHG emission components in the Protocol:

- material decomposition in a landfill;
- biodegradation treatment in a composting facility;
- fuel consumption in the composting operation;

- upstream extraction and processing of the fuel consumed in the composting operation; and
- downstream decomposition of composting residuals placed in a landfill.

For the calculations presented herein, it was assumed the L&YW was diverted from the landfill operation without any contaminants (e.g. contamination due to thin film plastic containers was excluded), and no biodegradable residuals remained after composting. Therefore only the first four components were included (Exhibit 9-1).

EXHIBIT 9-1

REDUCED EMISSION COMPONENTS FOR THE BASELINE (LANDFILLING) AND PROJECT (COMPOSTING).

	Emission Components
$\text{Emission}_{\text{landfilling}} =$	+ material decomposition
$\text{Emission}_{\text{composting}} =$	+ material treatment + composting operation + fuel extraction and processing

Carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) are significant in this investigation as these GHGs are commonly produced in landfills and composting operations. Each GHG has a different environmental impact as their atmospheric lifetime and heat-trapping potential are different (Environment 2007). Global warming potential (GWP) dictates the impact of GHG is expressed in terms of carbon dioxide gas. The GWP values for methane and nitrous oxide are 21 and 310, respectively, where one tonne of methane and one tonne of nitrous oxide have the same impact as 21 and 310 tonnes of carbon dioxide gas, respectively (Statistics Canada 2008).

9.2.1 Baseline (Landfill) Emissions

Exhibit 9-2 presents the equation and a summary of the parameters used to calculate the GHG emissions from a landfill. While most of the parameter values are typical for operations in Alberta, the amount of methane recovered (R) in Alberta landfills would need to be investigated further. At this time it was assumed no methane recovery occurred at the landfill. The methane values are then converted to carbon dioxide equivalents by multiplying by a standard global warming potential factor, which is 21 for methane. Substituting the values for the parameters into equation 2, results in: E_{baseline} (kg CO_2e) = 0.070 X 21 X M; where M = kg L&YW (wb). Using this equation, the landfill GHG emissions were calculated to be 735,000 tonnes CO_2e per year.

EXHIBIT 9-2

BASELINE (LANDFILLING) EMISSION CALCULATION

Description	Methane gas (CH4) is produced due to the anaerobic conditions in the landfill facility. Some of the methane gas may be captured and converted into energy (via a recovery system), some naturally oxidize and some escape to the atmosphere as emissions.
Equation used	$E_{baseline} = [(M \text{ X } \%disposal \text{ X } MCF \text{ X } DOC \text{ X } DOC_F \text{ X } F \text{ X } 16/12) - R] \text{ X } (1 - OX)$ **[2]**

Parameters

Symbol	Description	Value	Notes/References
M	mass of L&YW diverted from landfill to composting	kg (wet basis, WB) L&YW	Estimated value (CH2M Hill 2010)
%disposed	Adjusted baseline for Alberta related to an estimate of the amount of organic matter being diverted in 2002	0.8 (unitless)	Alberta Environment 2008; Nodelcorp 2009
MCF	methane correction factor; managed landfill	1 (unitless)	Nodelcorp 2009
DOC	degradable organic carbon	0.19 (unitless)	Alberta Environment 2008
DOC_F	fraction of degradable organic carbon dissimilated	0.77 (unitless)	Alberta Environment 2008
F	fraction of methane in landfill gas	0.5 (unitless)	Alberta Environment 2008
R	recovered methane; amount of methane recovered and converted to energy	0	Assumed no gas recovery
OX	oxidation factor; amount of methane passively oxidized in landfill cover	0.1 (unitless)	IPCC 2006

9.2.2 Project (Composting) Emissions

The project (composting) includes three emission components: (1) biodegradation treatment in a composting facility; (2) fuel consumption in the composting operation; and (3) upstream extraction and processing of the fuel consumed in the composting operation. The equations and parameters used to calculate these emissions are presented in Exhibits 7-3 to 7-5, respectively.

Emissions during biodegradation include methane and nitrous oxide (Exhibit 9-3). Substituting the values for the parameters into equation 3, results in: $E_{biodegradation}$ (kg CO_2e) = 0.177 X M; where M = kg L&YW (wb). Using this equation, the composting biodegradation GHG emissions were calculated to be 88,500 tonnes CO_2e per year.

Diesel fuel is consumed by the various equipment used to handle, turn and screen compost. Emissions from fuel consumption include carbon dioxide, methane and nitrous oxide (Exhibit

9-4). Substituting the values for the parameters into equation 4, results in: E_{diesel} (kg CO_2e) = 2.877 X V_{diesel}; where V_{diesel} = L. Using this equation, the emissions related to diesel fuel consumption were calculated to be 1,428.5 tonnes CO_2e per year.

EXHIBIT 9-3

MATERIAL BIODEGRADATION EMISSIONS DURING COMPOSTING CALCULATION

Description	During composting, the feedstock (waste) decomposes and emits GHG. Although aerobic conditions dominates, pockets of anaerobic degradation may occur.
Equation used	**$E_{biodegradation}$ = M [(21 X EF_{CH4}) + (310 X EF_{N2O})]** **[3]**

Parameters

Symbol	Description	Value used	Notes/References
M	mass of L&YW diverted from landfill to composting	kg (wet basis, WB) L&YW	Estimated value, CH2M Hill 2010; note the global warming potential factors for methane (21) and nitrous oxide (310) are included in equation 3.
EF	emission factors for material	0.004 kg CH_4 per kg waste 0.0003 kg N_2O per kg waste	Alberta Environment 2008

EXHIBIT 9-4

EMISSIONS FROM FUEL CONSUMPTION DURING COMPOSTING OPERATIONS

Description	GHGs are emitted during the operation and maintenance of composting due to the nature of the equipment(s) used. For example, the compost pile is formed and turned with heavy equipment. The equipment emits GHGs as it consumes fuel to travels to and from the pile and turning of the pile.
Equation used	**E = V_{diesel} [F_{CO2} + (F_{CH4} X 21) +(F_{NO2} X 310)] = 2.857 X V_{diesel}** **[4]**

Parameters

Symbol	Description	Value used	Notes/References
F_{diesel}	emission factor for diesel fuel used in composting equipment such as front-end loaders and turners.	2.73 kg CO_2 per L 0.000133 kg CH_4 per L 0.0004 kg N_2O per L	Alberta Environment 2008. Note the global warming potential factors for methane (21) and nitrous oxide (310) are included in equation 4.
V_{diesel}	volume of diesel fuel used	500,000 L	1 L per tonne of waste processed (Mohareb et al. 2008)

GHG emissions occur during the extraction and processing for diesel. Emissions from this component include carbon dioxide, methane and nitrous oxide (Exhibit 9-5). Substituting the values for the parameters into equation 5, results in: $E_{extraction}$ (kg CO_2e) = 0.368 X V_{diesel}; where V_{diesel} = L. Using this equation, the emissions related to diesel fuel extraction and processing were calculated to be 184 tonnes CO_2e per year.

EXHIBIT 9-5

UPSTREAM FUEL EXTRACTION AND PROCESSING EMISSION CALCULATIONS

Description	The production, refinement, and storage of fuels used are accounted for as these processes have emitted GHGs prior to the project (composting). The amount of emission depends on the fuel consumed during the course of the project.	
Equation used	$E_{extraction} = V_{diesel} [EF_{CO2} + (21 X EF_{CH4}) + (310 X EF_{N2O})]$	[5]

Parameters

Symbol	Description	Value used	Notes/References
EF_{diesel}	emission factor for fuel	0.138 kg CO_2 per L 0.0109 kg CH_4 per L 0.000004 kg N_2O per L	Alberta Environment 2008. Note the global warming potential factors for methane (21) and nitrous oxide (310) are included in equation 5.
V_{diesel}	volume of diesel fuel used	500,000 L	1 L fuel used per tonne waste (Mohareb et al. 2008)

9.2.3 Offset Credits

Since the baseline approach was involved, the GHG offset credit is the difference between emission determined from the baseline (landfill) and project (compost). Exhibit 9-6 summarizes the GHG calculations from landfilling and composting components. The net value is the maximum (theoretical) offset credit under the conditions assumed in this report. Factors such as participation levels, methane recovery in landfills, debagging operations, and energy required for heating buildings and running vehicles on site could change the net offset value significantly. For example, it is unrealistic to expect all 500,000 tonnes of material to be captured. In addition, aggregation of smaller projects may be needed to ensure the offset credits are of significant size. A notion worth exploring is to apply for offset credits based on the entire aggregated program. The program could be run from an agency external to the Government of Alberta for the purpose of administering the L&YW program, including GHG offset credits. Another issue relates to the dynamic nature of the offset credit program, e.g. the credit program may be phased out some time in the future.

The maximum theoretical offset credits are 644,890 t CO_2e per year, which represents a ratio of 1.29 (offset credit to diverted material). This ratio is considerably higher than the ratio of 0.958 that was found for the City of Edmonton's composting operations (Nodelcorp 2010). The main difference can be attributed to the downstream residual emission calculations. While these emissions were considered negligible for L&YW composting, a significant portion of Edmonton's MSW compost feedstock is landfilled as a residual.

The GHG offset credit potential of 644,890 t CO_2e per year is higher than would be expected based on the work of ICF (2005). ICF (2005) used a life cycle analysis (LCA) approach to estimate the impact of various waste management activities on GHG emissions in Canada. The report was completed for Environment Canada and Natural Resources Canada. One must keep in mind that the use of LCA is not a precise science. The output values can be quite different for the same questions based on the assumptions made by the analyst. For example, results from another LCA model, the ORWARE model, developed in Sweden, clearly showed landfills have a much higher GHG emission potential as compared to composting (Sundqvist 2004). The GHG emission values presented in this report were calculated using the protocol specifically developed for use in Alberta (Alberta Environment 2008). This protocol must be followed when calculating actual GHG offset credits for composting facilities in Alberta.

Current values of offset credits in Alberta range from \$10 to \$13.50 per to CO_2e (Savage 2010; Yee 2010). Using the mean of this range (\$11.75), results in a maximum theoretical credit of 7.58 million dollars per year.

There are direct costs associated with claiming offset credits: (1) quantifying emission reductions; (2) verifying claims; and (3) registering and trading offset credits. To date, only the City of Edmonton has successfully traded composting offset credits in the Alberta marketplace. Their respective costs were: \$6,500, \$15,000 and \$3,700 for a total cost of \$25,200 (Yee 2010). As the City of Edmonton claimed credits of 65,280 t CO_2e, this represents a cost of 38.6 cents per t CO_2e.

EXHIBIT 9-6

SUMMARY OF GHG EMISSIONS AND NET (OFFSET) CREDIT

	tonnes CO_2e/yr	kg CO_2e/tonne L&YW
Baseline (Landfilling)	735,000	1,470
Project (composting):		
Biodegradation	88,500	177
Fuel consumption	1,428.5	2.86
Fuel extraction & processing	184.0	0.368
Total (composting)	90,112.5	180.2
Offset Credits	**644,887.5**	**1,290**

9.3 Summary & Conclusions

The maximum theoretical GHG offset credit that can be achieved for L&YW in Alberta is 644,900 t CO_2e per year, which, at \$11.75 per t CO_2e, corresponds to a maximum credit of \$7.58 million per year. To determine the practical level of credits achievable, further investigation is required to determine (listed in order of decreasing importance):

1. The target L&YW diversion amount;
2. The level of methane recovery at landfills in Alberta;
3. How long the GHG offset credit program will be offered;
4. Whether aggregation of GHG offset credits can be done at a province-wide program level;
5. The impact of debagging and other operations;
6. The amount and fate of residual materials generated at a L&YW composting operation; and
7. Other potential GHG emissions from L&YW collection and processing operations.

10 L&YW Diversion Funding Programs

A review of federal and provincial grant funding programs was completed to identify programs that are specifically aimed as assisting/promoting L&YW diversion. The review also included selected jurisdictions in the United States that are considered to be proactive in terms of organic waste management.

The research showed that almost all the province and states reviewed have grant funding available for general solid waste reduction initiatives. However, only the Province of Quebec has a funding program that specifically targets L&YW and other organic wastes.

The review findings are summarized in Exhibit 10-1.

In the absence of specific programs for L&YW diversion, the scope of the review was expanded to identify funding programs in Canada that are used to encourage solid waste diversion. A summary of the programs identified is provided in Exhibits 10-2 and 10-3.

EXHIBIT 10-1

L&YW DIVERSION FUNDING PROGRAMS BY JURISDICTION

Jurisdiction	L&YW Diversion Grant Program(s)	Other Solid Waste Diversion Grant Program(s)
Canadian Jurisdictions		
British Columbia	×	✓
Alberta	×	✓(1)
Saskatchewan	×	✓
Manitoba	×	✓
Ontario	×	✓
Quebec	✓	✓
New Brunswick	×	✓
Nova Scotia	×	✓
Prince Edward Island	×	✓
Newfoundland and Labrador	×	✓
Yukon	×	✓
Northwest Territories	×	✓
Nunavut	×	×
Gov't of Canada	×	✓
US Jurisdictions		
Washington State	×	✓
Oregon	×	✓
California	×	✓
Florida	×	✓
New York	×	✓
Minnisota	×	✓
Texas	×	✓
Iowa	×	✓

Note 1: Alberta Environment's Reserouce Recovery Grant Program and Waste Management Assistance Program are currently not accepting applications.

10.1 Trends and Observations

Although organic waste is a significant component of the municipal solid waste stream, only the Province of Quebec has dedicated funding specifically towards the development of new organic waste diversion infrastructure. No other provincial, state or federal grant funding programs were identified through the research that specifically targeted L&YW or other organic wastes.

Aside from the Quebec program, only one program was found that targeted a specific material in the waste stream (i.e. NWT's Waste Paper Products Initiative).

Almost all jurisdictions offer some form of broader grant funding program to assist with solid waste reduction initiatives. For the most part, these grant programs appear to be funded from federal or provincial general revenues, although some are funded by "fees"collected though provincial stewardship programs (e.g. beverage containers, e-waste, tires). Only the Waste Reduction and Recycling Support (WRARS) fund in Manitoba was funded through disposal levies. The Environmental Damages Fund is unique in that the sources of funds are fines imposed by the Courts for environmental convictions.

Except for one fund in Yukon established specifically for bottle depot operators, all of the grant funds identified are accessible by municipalities (or groups of municipalites) and regional governments. Many of the funds are also accessible by NGO's. However, businesses and academic institutions are often excluded from accessing these funds. Federal grant programs are typically accessible by a broader range of organizations including businesses and academic institutions.

Most of the funding opportunities identified provide financial assistance in the form of grants. However, some funds provide loans, most notability the Green Municipal Fund sponsored by the Federation of Canadian Municipalities, and WDO's Continuous Improvement Fund.

There does not appear to be a universal trend that funds must be used for capital equipment purchases or infrastructure development, or to offset operating costs of programs. Funding programs will often consider applications for both of these aspects of diversion programs.

The normal practice for most funding agencies is to accept detailed proposals and/or business plans from applicants. In some cases these submissions are only accepted in response to specific proposal calls done at certain times during the year. The submissions received are subjected to a review process that allows for an equitable distribution of the funds available. In some cases, there are upper limits on the amount of funds that can be granted for a specific project.

EXHIBIT 10-2

PROVINCIAL WASTE MANAGEMENT FUNDING PROGRAMS

Funding Program	Sponsor(s)	Description	Eligibility	Source of Funds	Website
Resource Recovery Grant Program	Alberta Environment	Providing grants to municipalities to develop a resource recovery/recycling infrastructure. Funding may cover capital costs for materials handling equipment, basic structures or renovations to existing structures, site improvements, and signs and initial advertising. NOTE: Program is currently under review and is not taking applications.	Municipalities and NGO's	Provincial Treasury	http://www3.gov.ab.ca/env/waste/aow/grants/index.html
Waste Management Assistance Program	Alberta Environment	Provides technical and financial assistance to groups of municipalities to address their waste management needs. NOTE: Program is currently under review and is not taking applications.	Projects eligible for assistance include regional sanitary landfills, transfer stations, diversion and recycling facilities, and regional incinerators.	Provincial Treasury	http://www3.gov.ab.ca/env/waste/aow/grants/index.html
Go Green	Gov't of Saskatchewan	Financial commitment from the Provincial Gov't to assist Saskatchewan's people, communities, non-government organizations and businesses address environmental issues including greenhouse gas emission reduction/avoidance, water and biodiversity conservation, water quality restoration, and waste reduction.	Selected through RFP process. Applications open to municipalities, NGO's and businesses.	Provincial Treasury	http://www.environment.gov.sk.ca/fund
Waste Reduction and Pollution Prevention (WRAPP) Fund	Manitoba Conservation	WRAPP is a component of the Province's Sustainable Development Innovations Fund (SDIF). Its objectives are to demonstrate and promote the environmental and economic benefits of reducing or preventing waste; showcase local efforts to minimize waste; promote sustainable waste diversion or reduction activities; and demonstrate innovative approaches to reducing waste, preventing pollution, and conserving resources. Organic Waste Management is one of the Fund's four priority areas.	Municipal corporations, local governments, including Northern Affairs and First Nation communities, private and non-profit organizations and businesses, educational institutions, youth groups and community associations are eligible.	Provincial Treasury	http://www.gov.mb.ca/conservation/pollutionprevention/wrapp/wrappfund.html
Waste Reduction and Recycling Support (WRARS) Fund	Green Manitoba	A Waste Reduction and Recycling Support (WRARS) Levy of $10 per tonne is introduced on waste disposed at Manitoba landfills. The WRARS Levy is intended to help discourage waste generation and encourage increased recycling and waste diversion activities. Eighty percent of the revenue collected from this levy will be rebated to municipalities to further promote recycling in Manitoba, with the remainder of the funding to be used for increased support for provincial e-waste and hazardous waste collection programs across Manitoba.	Municipalities	Disposal Levies	http://www.greenmanitoba.ca/cim/1001.dhtm
Continuous Improvement Fund	Waste Diversion Ontario	The Continuous Improvement Fund (CIF) provides grants and loans to municipalities to execute projects that will increase the efficiency of municipal Blue Box recycling and help boost system effectiveness. The CIF started up in January 2008 and has a three year mandate to direct funding support to projects that will identify and implement best practices, examine and test emerging technologies, employ innovative solutions to increase blue box materials marketed, and promote gains in cost-effectiveness that can be implemented province-wide.	Ontario Municipalities	Steward's Fees	http://www.wdo.ca/cif/
Environmental Trust Fund	Gov't of New Brunswick	The Fund provides assistance for action-oriented projects with tangible, measurable results, aimed at protecting, preserving and enhancing the Province's natural environment. Projects must fall under one of the following categories: protection, restoration, sustainable development, conservation, education or beautification.	Academic Institutions, NGOs, Local Governments, First Nations, Registered Charities	Provincial Treasury	http://app.infoaa.7700.gnb.ca/gnb/Pub/EServices/ListServiceDetails.asp?ServiceID1=13136&ReportType1=All

Funding Program	Sponsor(s)	Description	Eligibility	Source of Funds	Website
Municipal Approved Programs	Nova Scotia Resource Recovery Fund Board (RRFB)	The Municipal Approved Funding Program is designed to enable RRFB Nova Scotia to financially support the efforts of municipal governments and waste-resource management regions in the continued advancement of waste reduction and diversion initiatives, the creation of jobs, and the municipal government commitment to the Nova Scotia Solid Waste-Resource Management Strategy. "Approved Funds" should be used for enhancing diversion/recycling methods and processes that support the goals of the Nova Scotia Solid Waste Resource Management Strategy and Regulations.	Municipalities, regional gov'ts, waste management regions	Steward's Fees, Deposits	http://www.rrfb.com/pages/forms.html
Special Projects Funding	Nova Scotia Resource Recovery Fund Board (RRFB)	Provides financial assistance to projects that do not meet the eligibility requirements of other RRFB programs. Projects must support the Province's Solid Waste-Resource Management Strategy and the mandates of RRFB	individual businesses, business associations, private and/or public partnerships, organizations, agencies, municipalities, and individuals.	Steward's Fees, Deposits	http://www.rrfb.com/pages/forms.html
Waste Management Trust Fund	Newfoundland and Labrador Multi Materials Stewardship Board (MMSB)	The Trust Fund provides financial assistance for the closure of waste disposal sites, regional waste management studies and waste management coordinators, education initiatives, and research on potential waste diversion and recycling initiatives.	Municipalities, businesses, Provincially owned and/or operated businesses, industry associations, post-secondary institutions, and NGOs	Steward Fees, Sale of recyclables	http://www.mmsb.nf.ca/wmfund.asp
Recycling Fund	Yukon Environment	The Recycling Fund is a dedicated fund set up under Yukon's Environment Act to receive surcharges paid on designated materials such as beverage containers. A portion of the Recycling Fund is used to provide grants for projects that improve recycling programs in the Yukon.	recycling depots registered under the Beverage Container Regulation	Deposits	www.environmentyukon.gov.yk.ca/documents/RecyclingFund_Guidelines.pdf
Waste Reduction and Recycling Initiative Fund	Yukon Environment	The Waste Reduction and Recycling Initiative (WRRI) funds small-scale projects that provide positive and lasting benefits by reducing the generation of waste; recycling materials on which a surcharge is not collected; or increase diversion of compostable materials from landfills. General types of projects that are eligible for WRRI funding include installation and/or improvement of facilities for "blue box" recyclable materials, community composting programs, educational programs designed to increase public awareness of and involvement in reduction, reuse and recycling initiatives, and projects that remove recyclable waste materials (such as large tires, electronic wastes or refrigerants from old appliances) from the environment.	Municipalities, NGO's and individuals.	Treasury	www.environmentyukon.gov.yk.ca/documents/WRRI_Guidelines.pdf
Waste Paper Products Initiative	NWT Environment and Natural Resource.	This three-year initiative provides financial assistance to NWT-based municipalities, organizations, businesses and individuals to initiate and develop alternative ways to reuse paper and cardboard destined for landfills. Paper-based materials include, but are not limited to, white paper, brown paper, coloured paper, boxboard, corrugated cardboard, magazines, catalogues, newspapers, egg cartons, etc. Eligible projects include pilot or demonstration of new technology for the collection, diversion, processing, manufacturing and distribution of materials recovered or diverted from the waste stream; and commercialization of new technology, products or services for materials recovered or diverted from the waste stream.	Eligible applicants include individual businesses, business associations, private and non-profit organizations, municipalities and local governments, educational institutions, and collaborative partnerships	Treasury	
Program for Treatment of Organic Materials by Composting and Anaerobic Digestion	PQ MOE	The Program provides financial support to municipalities and the private sector for the installation of infrastructure to treat organic matter through composting and anaerobic digestion. The program aims to reduce GHG emissions and the quantity of organic material being disposed of. The program is effective from November 16, 2009 to September 30, 2013.	Available to both the public and private sectors.	Landfill Disposal Levy	http://www.mddep.gouv.qc.ca/programmes/biomethanisation/index.htm

EXHIBIT 10-3
NATIONAL WASTE MANAGEMENT FUNDING PROGRAMS

Funding Program	Sponsor(s)	Description	Eligibility	Source of Funds	Website
Clean Technology Project Funding	Sustainable Development Technology Canada	SDTC supports clean-technology projects through the development and demonstration stages—without taking an equity stake, without requiring ownership of intellectual property or any repayment of funds.	Eligible projects must focus on the development and demonstration of new technologies that address issues of climate change, clean air, water and soil quality. The projects must be undertaken primarily in Canada.	Federal Treasury	http://sdtc.ca/en/
Environmental Damages Fund	Environment Canada	The Environmental Damages Fund (EDF) helps ensure polluters take responsibility for their actions. It gives courts a way to guarantee that the money from pollution penalties and settlements is directly invested to repair the actual harm done by the pollution.	Each award directed into the EDF is accounted for separately so that monies will only be used to fund projects in the watershed where the offense has occurred. Eligible projects must satisfy all conditions specified by the courts (if any); demonstrate broad community support (e.g. partnerships both financial and in-kind); must be scientifically sound, and technically feasible; be cost effective in achieving goals, objectives and results; and recipients must show that they possess or have access to the necessary experience, knowledge and skills required to undertake the project.	Criminal Fines	http://www.ec.gc.ca/edf-fde/default.asp?lang=En&n=C5BAD261-1
EcoAction Community Funding Program	Environment Canada	Provides financial support to community groups for projects that have measurable, positive impacts on the environment. Funding support can be requested for projects that have an action focus, a community capacity building focus, or a combination of both objectives.	Funding is available for projects that: Address Environment Canada's priority issues of Climate Change, Clean Air, Clean Water and/or Nature; Have positive, measurable impacts on the natural environment, build the capacity of communities to take action on environmental issues, or a combination of both objectives; Provide opportunities for Canadians to take positive action at the community level; and Encourage people to be more environmentally responsible.	Federal Treasury	http://www.ec.gc.ca/ecoaction/what_is_e.html
Green Municipal Fund	Federation of Canadian Municipalities	One of the objectives of the GMF is to increase waste diversion rates from landfill sites in Canada by offering loans, or grant and loan combinations to support the implementation of municipal solid waste (MSW) diversion projects. The level of funding offered to each project is linked to the anticipated environmental, social and economic benefits. The primary measure of environmental benefit for the RFP will be the forecast MSW diversion rates after implementation, based on metric tonnes/capita/year.	The GMF offers grants for feasibility studies, field tests and sustainable community plans, as well as grants and loans for capital implementation projects through a competitive Request for Proposal process. Projects that divert MSW from landfill through reuse, recycling, biological processes or thermal treatment are eligible for funding through this RFP.	FCM	http://www.sustainablecommunities.fcm.ca/GMF/Waste_RFP_2007.asp
Technology Early Action Measures	Natural Resources Canada (NRC)	Support to technology late-stage development and demonstration projects to reduce greenhouse gas emissions nationally and internationally, while sustaining economic and social development.	Project must: result in or lead directly to short-term GHG emission reductions; be innovative; have potential for replication; hold an appropriate level of risk; demonstrate the need for government involvement; and meet leveraging requirements.	Federal Treasury	http://www.team.gc.ca/english/
Technology Inflow Program	Natural Resources Canada (NRC)	To assist small and medium-sized enterprises access Canadian or foreign technology and to help develop R&D partnerships.		Federal Treasury	http://irap-pari.nrc-cnrc.gc.ca/tip_e.html

Funding Program	Sponsor(s)	Description	Eligibility	Source of Funds	Website
Youth Internships	National Research Council Department of Human Resources and Social Development	NRC-IRAP delivers two youth initiatives on behalf of the Youth Employment Strategy (YES). NRC-IRAP's Internship Program with Innovative Small and Medium-sized Enterprises and Collaborative Research Internships Program provide firms with support to hire post-secondary graduates.	To be eligible for these programs, your firm must: be a small or medium-sized enterprise (SME) with less than 500 employees be incorporated and for profit wish to enhance its innovation capability be willing to establish a trusting relationship with NRC-IRAP.	Federal Treasury	http://irap-pari.nrc-cnrc.gc.ca/youthinitiatives_e.html
Municipal Rural Infrastructure Fund	Infrastructure Canada Individual Provinces	The Municipal Rural Infrastructure Fund (MRIF) is a federal-provincial cost-shared program, which targets municipal and rural infrastructure that improves the quality of life and economic opportunities for communities.	Municipalities, as well as non-government organizations whose proposals are supported by municipal resolution.	Federal and Provincial Treasuries	http://www.infc.gc.ca/ip-pi/mrif-fimr/information-eng.html
Gas Tax Fund	Infrastructure Canada Individual Provinces	The Gas Tax Fund (GTF), a key component of the Building Canada infrastructure plan, is helping to build Canada's communities by providing predictable and long-term funding in support of municipal infrastructure that contributes to cleaner air, cleaner water and reduced greenhouse gas emissions. Municipalities can pool, bank and borrow against this funding.	Canadian Municipalities	Federal Treasury	http://www.infc.gc.ca/ip-pi/gtf-fte/gtf-fte-eng.html
Infrastructure Canada Program	Infrastructure Canada	The goal of the Infrastructure Canada Program (ICP) is to enhance municipal infrastructure in urban and rural communities across the country, and improve Canadians' quality of life through investments that protect our environment and support long-term economic growth. Green municipal infrastructure is the program's first priority.	Canadian Municipalities	Federal Treasury	http://www.infc.gc.ca/ip-pi/icp-pic/description-eng.html

11 L&YW Diversion Program Comparison

Several municipalities were contacted to obtain information on their L&YW diversion programs. This information was used by the project team to identify trends, key diversion programs and success factors, and to help form recommendations related to a differential tipping fee approach.

11.1 Current L&YW Processing and Disposal Fees in Alberta

In order to provide further clarification of the existing situation in Alberta related to L&YW management, a review of current L&YW disposal and processing fees charged by selected municipalities in the province was undertaken. The project team also collected specific information related to each municipality's use of differential tipping fees.

The summary of the information collected is provided in Exhibit 11-1.

11.2 L&YW Diversion Program outside of Alberta

A survey of several municipalities in Canada and the United States was undertaken using a combination of internet research, emails, and telephone contact. The municipalities included within the survey were chosen in consultation with Alberta Environment based on factors including geographic proximity, program scope and size, and perceived program success. Standardized questions were used to ensure consistency of the information collected.

The responses to the survey are summarized in Exhibit 11-2.

11.3 Trends and Observations

11.3.1 Collection Program Type

The type of collection program will influence the amount of L&YW diverted: it is generally accepted that curbside collection programs (which are generally more convenient and thus have a higher participation rates) will result in higher diversion rates.

Evidence of this trend is visible by doing a macro-comparison of Alberta and British Columbia. Alberta appears to have a lower number of curbside L&YW programs than British Columbia (drop-off depots appear to be the preferred method of diverting L&YW in Alberta). As a whole, British Columbia communities appear to have better success in diverting L&YW from landfill.

Additional evidence of this trend is demonstrated by the Cities of Calgary and Winnipeg, which provide only drop-off points for L&YW. These cities have much lower diversion rates than the City of Vancouver which provides curbside collection service and drop-off points for L&YW.

11.3.2 Mandatory vs Voluntary Collection Programs

Whether a program is mandatory or voluntary appears to have a significant impact on L&YW diversion rates. For example, in St. Albert and Saskatoon, seasonal curbside collection services for L&YW are provided on a voluntary (i.e. subscription) basis. Both these programs have struggled for several years to increase participation and diversion rates, despite the added convenience of the optional curbside service.

On the other hand, mandatory curbside L&YW collection programs in Kelowna divert a significantly higher amount of L&YW (even when the increased per capita generation rate of L&YW in Kelowna is taken into account). L&YW is banned from the residential waste collection program in Kelowna, and each resident is provided with curbside L&YW collection on a seasonal basis. The L&YW collection program is funded through monthly utility bill charges to each residence.

11.3.3 Processing Method

There does not appear to be any direct correlation between diversion rates and the method used to process L&YW.

11.3.4 Disposal Rates

Waste disposal rates vary significantly in Alberta and across the Country. The survey of current rates in Alberta revealed rates for disposal of MSW as low as $24 per tonne, and as high as $141 per tonne. Disposal rates in the range of $50 to $60 per tonne appear to be more typical.

Due to other influences (e.g. degree of education and awareness programming, type of collection programs), it is not possible to quantify the relationship between tipping fees and diversion rates. However, common wisdom would suggest that higher disposal fees would result in higher L&YW diversion rates, all other factors being equal.

Interestingly, the data does not support this premise. For example, Grande Prairie, which has a population similar to that of St. Albert, and a significantly higher landfill disposal fee, diverts less L&YW annually than St. Albert. Similarly, Camrose and Cold Lake appear to divert similar amounts of L&YW even though the disposal fees are over $100 per tonne higher in Cold Lake.

11.3.5 Differential Tipping Fees

Differential tipping fees refer to higher or lower processing/disposal rates for specific materials. This practice is typically used at waste facilities to provide an economic incentive to separate materials and participate in specific diversion programs (i.e. through lower fees), or a penalty for non-participation (i.e. through higher fees or "surcharges"), or both methods applied simultaneously in what proponents refer to as a "carrot-and-stick" scenario.

The use of differential tipping fees by municipalities in Canada is a common practice. In Alberta, the majority of large urban centers accept L&YW at a reduced rate relative to disposal charges, or at "no charge" (i.e. costs of L&YW processing are recouped indirectly through tax-base, utility fees, or disposal fees). The reduction or elimination of fees for L&YW is common to both large and small landfills, and at transfer stations. In most cases the acceptance of feedstocks at no charge is done consciously and with the understanding that other revenue sources (e.g. disposal fees) will subsidize processing costs of L&YW.

Although most landfills in Alberta charge their usual landfill disposal rate for mixed loads containing L&YW, two facilities were noted as having a "surcharge" for unsorted L&YW. The Francis Cooke Landfill, operated by the Bow Valley Waste Management Commission, charges a 180% premium (i.e. an extra $60/tonne) for unsorted L&YW loads. The premium charged by the Grande Prairie Landfill is 200% (i.e. $89/tonne).

11.3.6 Backyard Composting Programs

Backyard composting programs are offered by a number of municipalities. Programs range from provision of literature and information on how to build bins, to offering in depth "master composter" courses, and making home compost bins available at a subsidized rate or for free.

Compost demonstration gardens are also used by many municipalities (e.g. Edmonton, Vernon, Saskatoon) to further promote backyard composting.

It is difficult to determine whether backyard composter programs by themselves result in significantly higher L&YW diversion rates. There is often little follow-up by municipalities with residents who have received subsidized bins to understand if and how they are being used. There have even been reports of free compost bins being given away as Christmas gifts to family members living outside of the municipality. Most often these programs are part of a larger education and awareness program on solid waste reduction and recycling.

The unit cost of backyard compost programs (including the associated bin subsidies, education programs/ materials and staff time) relative to the amount of material diverted can be significantly greater than the cost per tonne of collection and centralized processing programs. Despite this, backyard composting programs continue to remain a popular component of municipal waste diversion programs, and indeed have a role in terms of public awareness and education.

11.3.7 Bag Limits

When implemented with a curbside or depot-based L&YW collection program, limiting the number of garbage bags that may be placed at the curb for collection appears to have a significant impact on L&YW diversion. In locations where bag limits do not exist (e.g. Edmonton), it is commonplace to see multiple bags of L&YW materials being set out for disposal as garbage. However, bag limits or tag-a-bag systems (which charge as much as $5 for bags in excess of a stated limit) appear to reduce this practice and drive participation in voluntary drop-off or subscription programs. Bag limits have been implemented in Airdrie, St. Albert, and Red Deer.

EXHIBIT 11-1
L&YW FEES IN ALBERTA

Municipality	MSW Tipping Fee [1] ($/tonne)	L&YW Disposal Surcharge ($/tonne)	L&YW Processing Fee ($/tonne)	Bulk Compost Price [3]
Airdrie (Spy Hill LF)	$20/pick-up load	None	No Charge	Internal
Brooks	N/A	N/A	N/A	
Calgary	$85	None	N/A	NR
Camrose	$32.50	None	No Charge	Internal
Canmore (Francis Cooke LF)	$75	$135	$40	---
Cold Lake	$141	None	No Charge	
Drayton Valley	$62	None	$62	Internal
Drumheller	$37.50	None	No Charge	
Edmonton	$58 (Res)/ $65 (Com)	None	$30	NR
Fort Saskatchewan	$15 per pick-up load	None	No Charge	
Grande Prairie	$89	$178	N/A	
High River (Foothills LF)	$60	None	No Charge for grass	$25/tonne
Hinton	$50	None	None	---
Leduc (Leduc Reg. LF)	No Charge [2]	None	No Charge	---
Lethbridge	$54.50	None	No Charge	
Lloydminster	$24	None	None	---
Mackenzie County	$49.25	None	N/A	
Medicine Hat	$25	$25 for Bagged L&YW	No Charge	$16/tonne
Municipality of Crowsnest Pass	$43.14	None	N/A	---
Municipality of Jasper	N/A	None	None	
Red Deer	$56	None	$56	$15/yd[3]
Reg. Mun. of Wood Buffalo	$48.71	None	No Charge	Internal
Spruce Grove	$35/truck load	None	$10/truck load	---
St. Albert (WM Landfill)	N/A	None	No Charge @ depot	---
Strathcona County (Cloverbar LF)	$58 (Res)/ $65 (Com)	None	No Charge @ depot	---
Wetaskiwin	$85	None	No Charge	

Notes:

1. Posted gate rate for businesses & residents. Where "out-off-boundary" rates exist, Waste Authority member rates are listed.

2. Tipping Fees are paid for by City of Leduc through an agreement with the Waste Authority.

3. Reported bulk prices fob compost facility as reported during survey conducted Fall 2009. "---" indicates that municipality does not operate their own compost facility. "NR" indicates not reported. "Internal" indicates product used internally and not sold.

EXHIBIT 11-2
SUMMARY OF L&YW DIVERSION PROGRAMS

Name of Community		Collection Program Details	Organics Handling Process	SSO collection also in place?	Additional Tools	Tipping Fees	Funding Structure	L&YW Diversion Rate
City of Kamloops	BC	No curbside collection program. L&YW can be dropped off for free at compost facility or depots.	Composted at Cinnamon Ridge using dedicated windrow turner. Compost sold for $20/cubic meter.	No	Additional tools the City of Kamloops uses is public education in regards to back yard composters and grasscycling. We try to enourage people to use backyard composters by explaining the benefits such as nutrient rich soil that they can use in their flower beds or gardens. Grasscyling is also encouraged as it reduces waste to the landfill but also helps in reducing the need for constant watering. Grass clipping are also banned from the curbside garbage pick-up program but can be taken to the Cinnamon Ridge for free. We also have a Christmas tree chipping program. A number of sites throughout the city are set up over the holidays where residents can drop off their used Christmas trees. Trees are chipped and sent to Cinnamon Ridge. There are other educational programs related to healthy landscapes, pesticide reduction, xeriscape, etc.	$60/tonne for garbage and L&YW. L&YW free to drop off at compost sites	General taxation. In the future our tipping fees will also fund these initiatives.	City has no firm information on how much waste is being buried at the landfills. In 2009, they hauled close to 18,000 cubic yards of ground material from the two yard waste drop off sites to Cinnamon Ridge, and an additional 18,000 cu was yds received at Cinnamon Ridge. City expects to have a better grasp on these numbers at the end of this year.
City of Kelowna	BC	Single-family residences are provided with a single wheeled container, which is emptied at the curb by an automated collection vehicle biweekly from March to November. Residents may also haul to landfill free of charge. Commercial vehicles are charged $25/tonne.	L&YW is ground and used in two composting programs. Processed in turned windrow facility on landfill site to make compost; also transported ~20km north to provide feedstock for biosolids compost produced in extended aerated static pile system. Both products sold locally at about $30/yd3 retail, and are in great demand.	No	Regional Waste reduction office jointly funded by member municipalities, with large tax base, has a well-developed public education program with many facets including master composter program, composter sales, compost demonstration garden, "Go Natural Garden Parties", to name a few.	Garbage$55/tonne; $25/tonne for L&YW coming from commercial sources, free from res'l.	Complicated with some funding in parcel taxes and some in annual fees.	Very high, but recent switch from unlimited bags to single wheeled cart may have reduced diversion rate, as fixed volume carts are somewhat limiting for heavy collection times in spring and fall.
City of Vancouver	BC	Automated biweekly collection from wheeled carts provided year-round to residents. City plans to add kitchen waste for a full SSO program in April.	Ground and composted in turned windrow system at Vancouver Landfill. Screened compost sold at $10/m3 or $6/m3 for volumes of greater than 6m3. City will also deliver for an additional delivery charge.	Starting April 22, 2010	Large tax base funds many public education and waste reduction programs, composters sold at half retail rate (at cost) on an ongoing basis.	Garbage $82; L&YW $59	Utility fee determined by size and number of carts at each residence. Tipping fees at landfill and revenue from compost sales help fund composting operation.	The current diversion rate for the region is calculated at 55%. Overall "Yard & Garden" is about 5% of material disposed in the region.
City of Vernon	BC	Yard waste is collected in clear plastic bags or bundles at the curb (once in spring and once in fall). No bag limit. Tipping fees at landfill are waived for L&YW for two six-week periods (one in the spring and one in fall). The City also has a spring chipping program where a mobile chipper collects branches left at the curb by residents in late March and early April.	L&YW is ground and used on site to cover landfill areas for aesthetics and dust suppression. A new composting facility at the landfill will begin construction within the next couple of months (spring 2010).	No	Homeowners are encouraged to place leaves at curb 1 week early for "leaf exchange" should people wish to collect them for home composters. Subsidized composter sales. Dedicated waste reduction staff from Regional District conducts school programs and other public education. Compost demonstration garden in large downtown park.	Garbage $63/tonne; L&YW $20/tonne; free during Anti-Burning Campaign periods in spring and fall.	Curbside programs funded by annual fee. All landfill functions are funded by tipping fees.	Large volumes diverted, but according to waste composition study, organic yard waste from residences and landscaping still made up 25% of waste entering the landfill in May/June 2005.
District of Summerland	BC	Curbside collection programs are the same as those within the Regional District of Okanagan Similkameen in adjacent areas, deliberately harmonized to reduce public confusion. See Penticton for details.	Self-haul leaves and grass clippings are stockpiled separately from woody debris and curbside program material. Woody material is ground up, and mixed with leaves and grass clippings and biosolids, and incorporated into a turned windrow composting system. Some apple culls from orchards also incorporated. Screened finished compost is sold to residents.	No	One subsidized backyard composter sale, supported by grant funding.	Tipping fees harmonized with RDOS (Penticton) fees to limit "landfill shopping" by the public.	Tipping fees and annual parcel tax for grinding and composting at the landfill, monthly utility bill for curbside service.	Excellent diversion - small town so everyone knows to take their prunings to landfill compost. In 2009 we diverted 1,270 tonnes of leaf and yard waste. Many large rural properties - deal with their own organic waste for the most part.

EXHIBIT 11-2
SUMMARY OF L&YW DIVERSION PROGRAMS

Name of Community		Collection Program Details	Organics Handling Process	SSO collection also in place?	Additional Tools	Tipping Fees	Funding Structure	L&YW Diversion Rate
Penticton	BC	Single-family residences are provided with six L&YW collection events spaced evenly from March through November. L&YW must be placed in clear plastic bags that weigh less than 25kg each when filled. Prunings may be bundled, provided bundles are fastened with biodegradable twine, meet the maximum 25kg limit, and are no more than 1 meter in length. There is no limit on the number of bags or bundles which may be placed at the curb. Residents and businesses may also haul L&YW to district landfills free of charge for amounts of less than 500kg. Grass clippings are banned from the landfill, although a recent informal waste composition study showed that the ban is sometimes ignored.	L&YW is ground several times per year at the landfill and incorporated into an on-site biosolids composting program that uses aerated static pile technology. Compost produced is screened and sold to residents. Excess material is stabilized in turned windrows and used for dust control and aesthetics on site, or on top of final cover as an organic layer.	No	Public education on composting and grasscycling including literature, website information and school programs, occasional subsidized backyard composter sales; compost demonstration garden; Master Composter program.	Free of charge up to 500 kg. Loads over 500kg are charged $25 per tonne, as larger loads are assumed to have come from commercial sources. Cost for Garbage is $55/tonne.	Tipping fees for waste subsidize landfill diversion programs. Small annual fee on household tax notices. Households are charged an annual fee for curbside programs.	Diversion rate unknown: no formal waste composition studies. An informal check on garbage entering landfill indicated that grass clippings still coming in, in garbage, to some degree.
Salmon Arm	BC	Spring curbside chipping service for single family residential properties up to 1 acre, for small branches and prunings only. Yard waste accepted free at landfill for six-week period in spring and another in the fall.	The organics collected at the landfill are put through the wood chipper, and the chips are used for blending for alternate cover, or used for road building material on site. Approx 1500 dry tonnes was sent to a co-gen plant in Armstrong last year from the landfill.	No	Public Education through newsletters, other avenues. Various round-up events coordinated through the Regional District. The Municipality takes care of the curbside chipping program. CSRD has the two free six week collection periods at the landfills and transfer stations. The CSRD has started a composter incentive program, where composters are sold to residents at cost, and are required to attend a 30 minute training session on how to use the units. We are also working on the development of a Master Composter Program. A biannual newsletter goes out to all residents with information on home composting.	Garbage $70/tonne. L&YW $35/tonne	Landfills are funded strictly through tipping fees, with fees for materials set based on the cost to handle the material. Recycling depots are funded through taxation	The last Waste Composition Study was done in 2006, indicating 30% of the material sampled was organic. We collected 2875 tonnes of L&YW material in 2009, and garbage to the active face was 11488 tonne, material to the DLC area was 40219 tonnes.
Town of Armstrong	BC	Yard waste is collected in clear plastic bags or bundles at the curb, once in spring and once in fall. No bag limit. Tipping fees are waived for L&YW for two six-week periods (one in the spring and one in fall).	L&YW is ground and used on site to cover landfill areas for aesthetics and dust suppression.	No	Public education, through Regional District using same waste reduction staff as City of Vernon, occasional subsidized composter sales held jointly with other adjacent local government bodies.	Garbage $63/tonne; L&YW $20/tonne; free during Anti-Burning Campaign periods in spring and fall.	Curbside programs funded by annual fee. All landfill functions are funded by tipping fees	Significant proportion of residents serviced live on large rural properties and deal with their own yard trimmings. Good diversion for the area. May/June 2005 waste composition study showed 16% of waste entering landfill was L&YW from residential and landscaping sources.
Town of Oliver	BC	Same curbside collection program for L&YW as the RDOS (Penticton)	L&YW stockpile at landfill is ground and given to cattle feedlot next door for use as bedding, which is eventually composted and sold by feedlot owner. It is also given to nearby vineyard for compost feedstock. Prunings and yard waste generated by municipal workers is composted at public works yard. Residents can drop off Christmas trees at public works yard to be chipped and composted there.	No	Participate in some RDOS waste reduction public education programs, such as informational curbside calendar, school programs.	Free of charge up to 500 kg. Loads over 500kg are charged $25 per tonne, as larger loads are assumed to have come from commercial sources. Cost for Garbage is $55/tonne.	Same as RDOS (Penticton)	Good diversion from more compact lots. Many large rural properties in area, which often deal with L&YW on their own. Material not being buried in significant volume.
Town of Osoyoos	BC	Same as the RDOS (Penticton)	L&YW is ground and composted. Some mixed with bisolids and used on site in final cover, rest either used on site or given to the public.	No	Osoyoos participates in curbside calendar that is given to homeowners throughout RDOS curbside areas. Sets up drop-off locations for Christmas trees for chipping.	Garbage - $65/tonne. L&YW - under 500 kg free; over 500 kg $25 for portion overweight with $2 min charge	N/A	Many rural properties in area which deal with L&YW on their own. Good diversion from more compact lots, material not being buried in significant volume.

EXHIBIT 11-2
SUMMARY OF L&YW DIVERSION PROGRAMS

Name of Community		Collection Program Details	Organics Handling Process	SSO collection also in place?	Additional Tools	Tipping Fees	Funding Structure	L&YW Diversion Rate
City of Saskatoon	SK	The City's current organic collection involves two compost depots located on McOrmond Drive and on Highway 7. These free of charge compost depots collect leaves, grass, non-elm tree and shrub branches and pumpkins that would otherwise end up in the landfill. The sites also incorporate programs such as Christmas tree collection, parks organics and minimal industrial feed and vegetable products. Leaf & yard waste subscribers can receive bi-weekly pickup of leaves and grass at an additional $40 charge. Currently the volunteer subscription program has 1,600 participants.	Green waste material was processed through a grinder. All material is handled by a loader operator and composted into Static Aerated Piles. Final screening also occurred on last years material. The utilization of finished composting has grown modestly over the last couple years. Some of the material was taken by the City's Parks Branch for community gardens. The material was also used in City slope stabilization projects. Currently the material is being used for City use and not marketed for a cost.	No	The City of Saskatoon currently partners with the non-profit Saskatchewan Waste Reduction Council (SWRC) for waste diversion programs. SWRC staff currently operates the two sites and helps in other public education programs. Programs throughout the year include the City's pumpkin drop-off during Halloween and Christmas tree drop-off locations during the holiday season. In the spring, the City has a truckload subsidized backyard composter sale which are expected to sell 1000 units. $10 subsidies are available on any compost bins purchased and distributed through SWRC. City Park Compost Demonstration Gardens have a Master Composter on site on Saturday mornings to help manage compost materials and answer compost questions. Other public education campaigns include "Be Caught in the Act" during National Waste Reduction Week, which includes prizes for participation at any of the City's depots. Additional awareness goes out through communications in utility bill stuffers, website, recycling brochures and public announcements.	Landfill fees are based on a $10 entrance fee and an additional per tonnage cost. $55/tonne for loads over 351 kg. Leaf and yard waste materials is directed to the nearby Highway 7 Compost Depot where it is free of charge. Elm species are considered solid waste at the landfill and are charged accordingly.	The compost depots are currently paid through Capital Budgets through the City of Saskatoon.	In 2008, the two compost sites received approximately 4,200 tonnes of organics. 2009 saw the increase in diversion to 17,500 tonnes of organics, largely due to the inclusion of wood waste (pallets, logs and branches from non-elm trees). 2006 waste audits indicate yard waste accounts for 28% of the residential sector, 5% of the ICI sector (wood accounts for another additional 23%). Current diversion rates for all recycled materials (C&D, compost, recyclables) is 19%.
Prince Albert	SK	Biweekly collection of yard waste in clear plastic bags after May long weekend through to the last week in October, weather permitting. No bag limit.	The leaves and grass are collected and hauled to an area within the landfill area. They are mixed as they come into the landfill with all the grass and leaves that are collected. Some municipal solid waste is occasionally mixed in to speed up the compost process. Composting at the landfill is low tech - use a loader to mix the grass and leaves. Compost material used on the north side of landfill for cover material - do not try to make a saleable material as it is used in a rough state.	No	Home composting info on website along with list of composting links.	Refuse $42/tonne; Brush $3/tonne; Yard Waste free of charge	The collection of the curbside compost is an operational budget item. We do however charge each single family resident a $12.60 monthly charge on there water bill. This is called a Sanitation Utility surcharge, however this was to include an offset cost in the collection of recyclables and landfill expansion. The surcharge is $45.00 / month for commercial apartments or business where the City collects there garbage and recyclables. The surcharge is mandatory for single residents however if a commercial business wants to use a private hauler they are not charge the surcharge.	Quantity records limited as they do not weigh in the private vehicles that bring in this material. Compost truck is weighed and for the past couple of years it brings in about 550 tonnes of grass and leaves each year. The residents that haul their own grass and leaves would be similar in volume to what our truck hauls. This is from a visual concept only.

EXHIBIT 11-2
SUMMARY OF L&YW DIVERSION PROGRAMS

Name of Community		Collection Program Details	Organics Handling Process	SSO collection also in place?	Additional Tools	Tipping Fees	Funding Structure	L&YW Diversion Rate
City of Winnipeg	MB	L&YW can be dropped off at 11 depots and 1 landfill free of charge. No woody material. Residents can also have L&YW picked up by a local non-profit group for a donation. One neighbourhood has several community gardens where leaves can be dropped off for composting.	Material composted in turned windrows at landfill; used on landfill for landscaping closed areas	No	Public education, distribution of information on composting and grasscycling, subsidized composter sale.	Free; Garbage at landfill $43.50/tonne	landfill tipping fees	4794 tonnes of Yard Waste in 2009; 2009 Residential garbage = 239,000 tonnes (approx)
City of Brampton	ON	All yard waste including grass clippings are collected at the curb weekly in April, June, October and November, and Biweekly in July, August and September. Acceptable containers include labeled open rigid reusable containers, bushel baskets, kraft paper yard waste bags and bundled prunings. Christmas trees picked up at the curb during designated week in January. Fall leaf vacuum program where work crews collect the leaves that residents rake to the curb using leaf vacuum vehicles - only in heavily-treed core area.	Composted in aerated tunnels. Material visually inspected for contaminants, ground and composted in aerated containers. Leachate recirculated. Material cured, then screened and sold for $35/tonne. Municipality will deliver compost, minimum 2 tonnes, for an additional charge.	Yes	The Region of Peel provides subsidized back yard composters; grasscycling information (currently there is no ban on grass clippings), in-home water conservation visits which include grasscycling, home composting and mulching conducted by our Public Education and Outreach Division:	Refuse and L&YW are $80/tonne	Curbside collection and processing (centralized composting) programs are funded through Property Taxation and user pay drop-off tipping fees.	Calculated to be about 88% diversion of all organics, including L&YW.
City of Brantford	ON	Yard waste collected weekly in April, May, June, Oct and Nov, in compostable paper bags, open rigid reusable containers or bundles. 30 container limit; no plastic bags. Christmas trees collected curbside in January in "Merry Mulch" program.	Composted. City provides finished compost free of charge to city residents.	No	One-day subsidized composter sale, $20 each.	L&YW free of charge April 5 to Nov 30; $40/tonne remainder of year. Garbage $65/tonne.	N/A	N/A
City of London	ON	Eight collection weeks distributed throughout the growing season (Mar to Nov), with frequency increasing through Oct and Nov. Items must be placed at the curb by 7am Monday and will be collected at some point during the week. Acceptable containers include reusable rigid containers, kraft paper bags, certified compostable plastic bags, and bundles tied with string or rope. Also 3 "Enviro-Depots" for free drop-off. Grass clippings not accepted in curbside program but may be dropped off at Enviro Depots for $1 per bag Depots set up for Christmas trees. Any left at curb is collected as garbage.	Composted. City sells compost to residents for $2 per 30 litre bag on special days; proceeds go to organizations that provide the volunteers to run each site. Also available from Enviro Depots.	No	Subsidized backyard composters made available to residents for $30 each.	$75/tonne for garbage, $1/bag for grass clippings, fall leaves no charge; no listing for general L&YW	N/A	N/A

EXHIBIT 11-2
SUMMARY OF L&YW DIVERSION PROGRAMS

Name of Community		Collection Program Details	Organics Handling Process	SSO collection also in place?	Additional Tools	Tipping Fees	Funding Structure	L&YW Diversion Rate
City of Toronto	ON	Yard waste collected biweekly at the curb in January and from mid-March to mid-December, in open-top reusable containers, bundles or kraft paper bags (no plastic). Single family residences only. City also provides curbside mechanical leaf collection from areas with an abundance of mature deciduous trees.The City's Transfer Stations also receive L&YM year-round from the City's Parks, Forestry and Recreation and Transportation Services Divisions, as well as from City Agencies, Boards, Commissions and Departments (ABCD). Residents and contractors are also permitted to deliver L&YM to City Transfer Stations	Composted. Multiple contractors are responsible for processing the City's L&YM. The City supplies the annual quantity of L&YM and provides haulage services to deliver L&YM to the contractors' Facilities using the City's tractor-trailer vehicles. The actual quantities vary due to operational requirements or other factors. The contractors typically utilize various technologies such as turned windrow systems. The Contractor provides to the City a percentage of compost produced through processing the L&YM and market the remaining. The City provides free compost depots on Community Environment Day event each year.	Yes	Website information on composting available. Public education, collection calendars with information in, Community Environment Days	$100/tonne for both refuse and L&YW	Through SWMS utility programs (e.g. user-pay program/volume based structure)	Information regarding the Residential Waste Diversion Rate and the breakdown by materials are available at: http://www.toronto.ca/garbage/residential-diversion.htm
City of Windsor	ON	Yard waste collected at the curb from April to January. Two times per month in April, May and November; once from June to Oct. and in Dec and Jan. Acceptable materials include leaves, branches and trimmings. Grass clippings accepted in months other than June through Sept. Acceptable containers include paper bags, garbage cans, cardboard boxes and "herby curby" wheeled plastic containers. Bundles tied with twine also picked up. No container limit. Christmas tree and any left over yard waste collection is scheduled for January. Stumps of any size can be dropped off at depot for free.	Material ground, composted in turned windrow system and screened to one half inch. Final product is sold.	No	Website information on composting, grasscycling.	Tree trimmings, brush, leaves, Ash trees and tree stumps up to 12" dia. are accepted free of charge. All stumps can be dropped off at depot for free. Grass clippings can be delivered to depot for $2 per container or $15 per cubic meter. Yard waste delivered by rental vehicle or rental trailer, or vehicle with dealer plates is charged $42/tonne. Refuse is $55/tonne at landfill, or $60 at transfer stations.	Revenue from compost helps offset the cost of the program.	N/A
Niagara Region	ON	Small diameter yard waste (small branches, grass clippings, weeds and leaves) is collected at the curb weekly. Acceptable containers include reusable rigid container, kraft paper bags, SSO green bins. City provides special labels for containers for organics. Six separate branch collections in spring and fall for larger woody material under 7cm diameter.	Composted at Elm Street Landfill Site until March of 2009.	Yes	"Smart Gardening" program workshops, website information, public education, recruitment of "neighbourhood ambassadors". Landfill ban on organics.	Garbage $80/tonne; L&YW $80/tonne for commercial; Free for residential	N/A	N/A
Simcoe County	ON	Approximately half of the sixteen member municipalities hold curbside leaf and yard wast collection events in the spring and fall. Material must be placed in kraft paper yard waste bags, reusable rigid open top containers or unwaxed cardboard boxes. "Brush" is usually collected separately, and must be bundled. Self-haul also.	Leaf & yard waste is ground using a Peterson 6700 horizontal grinder and placed into windrows. Materials is turned weekly with front end loaders, piles are monitored for temperature, moisture and pH. Samples are taken for laboratory analysis through the year. Material that has completed the composting process is screened in the Spring and sold. Residential price is $5/car load or $20 for pick up or trailer load. Commercial load pricing is negotiated dependent on volume.	Yes	public education & subsidized composters	$35/tonne compared to $115/tonne for garbage	tipping fees	Does not permit disposal of L&YW in its landfills. Require facility users to sort divertible materials with a penalty of $230/tonne for failure to comply. County does not believe that there are any issues with L&YW ending up in the landfills. From a curbside perspective they completed a comprehensive waste audit throughout 2006 and have just begun another this year but have no data available for 2010 as yet. In 2006 it was found that the average household had 11.34 kgs. in total of 'waste' weekly. Of that .01 kgs. was L&YW.
Town of Aurora	ON	Yard waste collected biweekly at the curb from residential properties from April to November in compostable paper bags, reusable rigid open containers, or bundles. Drop depots provided. Curbside Christmas tree pickup.	Turned windrow composting system with computerized monitoring. Other feedstocks include "agricultural", "aquatic" and SSO. Compost is sold. Custom screening available.	Yes	In the past we Aurora purchased back yard composters and sold them below cost to our residents. Currently we are not selling them. Other municipalities in York Region do sell backyard composters. The average price is : $21.00	The Town of Aurora does not pay any tipping fees for L&YW or general refuse.	L&YW collection is budgeted through our recycling contract. Education programs are also included in our recycling budget. At the processing level it is done through York Region.	In 2009, diverted 2401.98 tonnes of yard waste compared to 2008 diversion of 2110.61 tonnes
Town of Newmarket	ON	Yard waste collected biweekly at the curb from residential properties from April to November in compostable paper bags, reusable rigid open containers, or bundles. No grass clippings accepted. Drop depots provided. Curbside Christmas tree pickup.	Turned windrow composting system. Compost is sold.	Yes	Composter sales twice a year. At $30 instead of $36.	$65/tonne for "commercial" quantities (>1yd^3); free for less.	N/A	N/A
Ville de Montreal	PQ	Yard waste is collected at the curb weekly from April through November in compostable bags, reusable rigid containers or bundles, with dead leaves to be separated from other L&YW.	L&YW composted at Mironor compost site. Leaves composted at CESM	N/A		$40/residential pickup truck load regardless of whether it is garbage or yard waste, or other material.		

EXHIBIT 11-2
SUMMARY OF L&YW DIVERSION PROGRAMS

Name of Community		Collection Program Details	Organics Handling Process	SSO collection also in place?	Additional Tools	Tipping Fees	Funding Structure	L&YW Diversion Rate
Town of Wolfville	NS	Brush and pine needles collected biweekly with limit of 2 bundles of brush and 2 clear plastic bags of pine needles. Leaves collected only during fall clean-up with no bag limit imposed. Curbside Christmas tree pickup. (There is also a full SSO curbside collection, separate from collection of brush, pine needles and autumn leaves.)	All source separated waste is marshalled at management centres where it is sent on to be composted, recycled, reused or landfilled.	Yes	Lots of public education, from presentations to waste audits and more. Supports aggressive waste reduction programs.	Garbage $98/tonne; Food waste $88/tonne; L&YW $77/tonne; Wood/Brush $52/tonne; Leaves accepted free of charge during 5-week spring clean-up period	N/A	Extremely high as garbage must be placed in clear bags to ensure no contamination by recyclable or compostable materials, both at the curb and at the waste management facility. Loads inspected to ensure compliance.
City of Bellingham	WA	No curbside collection of L&YW is provided by the municipality. Citizens can arrange for curb-side pick up from the local waste hauler Sanitary Service. The Bellingham Clean Green Transfer Station accepts residential-only self-haul yard waste on weekends from March through November. Fee of $4 per load.	Material collected is composted.	No	N/A	N/A	N/A	N/A
City of Tacoma	WA	Residents who subscribe to curbside collection programs are provided with up to two 90 gallon wheeled containers, which are emptied at the curb by automated collection vehicle, biweekly all year long. Additional containers available for $3/month.	L&YW is transferred by the City to the LRI Compost Factory, where it is processed into a compost using enclosed mass bed system. Compost is sold wholesale to select topsoil companies	No	Will be starting a compost bin program, and have historically participated in Northwest Natural Yard Days and mulching mower sales events. Also are starting a natural yard care program for a more focused education program.	Residents L&YW free of charge; Non-residents $150/ton; Businesses $130/ton. Branches max 4' long, 8" diam.	Funded as part of our overall tipping fees and service fees for garbage, with a very small portion coming from grants.	Handled about 31,000 tons of organics last year (just Tacoma's programs) and disposed of 167371 tons from our total system. Doing a waste composition study now, no statistically valid data yet.
City of South San Francisco, San Mateo County	CA	Curbside service contracted out to South San Francisco Scavengers. L&YW collected biweekly from roll carts provided to residential customers. Additional bins can be rented for $1.50/month.	Composted	N/A	Free Composting Classes offered as well as compost facility tours. Discount backyard composters available. Master Composter Program. Green Bag lunchtime lecture series.	N/A	N/A	N/A
City of Troutdale	OR	Yard waste is collected at the curb weekly in 60-gallon roll-carts, year round. (Separate roll carts provided for garbage and recycling, and bin for glass.) Additional kraft paper bags or 32 gallon garbage cans of yard waste may be placed at the curb for a fee of $4 each. Additional carts can be used for an additional monthly charge. Customers who compost their own yard waste can apply for an exemption. In addition, one truckload of yard debris is accepted free-of-charge from each residential property during the 'spring clean-up' event.	N/A	No	Composting info available on municipal website.	N/A	N/A	N/A
Amherst	NY	Yard waste collected weekly from April through November in kraft paper bags, reusable rigid containers with handles, or bundled with twine or other biodegradable fastener. Transported to compost facility for processing. Larger material such as logs and stumps and large volumes of branches picked up during spring clean-up period.	Processed at Amherst Compost Facility, permitted for 85,000 tons annually. Preground and composted in large windrows turned with straddle-type windrow turner. Screened compost is sold for $16/cubic yard.	No	N/A	Residents may drop off leaf and yard waste free of charge. Is this also true for commercial customers?	N/A	N/A

12 Provincial L&YW Diversion Program Recommendations

The Project Team was retained to research and compile background information needed to finalize a provincial Leaf and Yard Waste (L&YW) Diversion Strategy. As part of this assignment, the Project Team was further asked to review the program recommendations put forward by L&YW Diversion Technical Committee. Specifically, the Project Team committed to:

- Provide recommendations on the most appropriate policy tools and economic instruments for implementation on a province-wide basis;
- Provide specific recommendations on whether a differential tipping fee system could be effectively implemented at all Alberta disposal facilities, facilities or only at facilities of a certain size, and what logistical or operational hurtles might be involved; and
- Determine what would constitute reasonable diversion targets for L&YW in Alberta and whether there is a basis for regional targets (vs. a province-wide target).

12.1 Program Recommendations

Based upon the research completed as part of this assignment, as well as the collective experience of the Project Team, the following program foundations and components are recommended as being part of a province-wide L&YW diversion program that would be implemented by Alberta Environment:

- Disposal bans should not be used as a means of driving participation in L&YW diversion programs at this time. Instead, disposal facility operators should be encouraged to implement differential tipping fee structures that encourage source separation and participation in reduction/diversion programs, and which are based on full-cost accounting practices.
- Municipalities should be encouraged to implement appropriate programs at the curbside that encourage participation in L&YW diversion programs (e.g. bag-limits, tag-a-bag, L&YW collection bans).
- A levy on all municipal solid wastes disposed of in Class II and III landfills should be implemented by Alberta Environment to provide a source of funding for province-wide L&YW diversion programs. Levies would be collected from waste generators at the disposal facility, and remitted to the province-wide fund on a regular basis.
- Funds collected through the disposal levy should be used to:
    - Develop an education and awareness program and resources that can be adopted by municipalities and other organizations throughout the province;
    - Develop uses and markets for beneficial products produced from L&YW (e.g. compost, mulch);
    - Train facility operators on best management practices;
    - Fund of L&YW diversion/processing operations based on verified records of beneficial products having been produced; and

  - Implement best management practices and program improvements at processing operations.

- To prevent burning from being used as a means of avoiding disposal charges and levies, Alberta Environment should work together with municipalities to strengthen bylaws and guidelines related to burning at landfills and on private property.

- Reporting and monitoring on program effectiveness.

These components are intended to provide a province-wide framework that would harmonize that actions of individual municipalities, and provide incentives to L&YW generators.

12.1.1 Beneficial Reuse

Much of the focus of this project has been on the investigation of composting as a means of diverting and managing L&YW. While composting is well established and understood, the Project Team believes that a province-wide program should not exclude other management methods and technologies. For example, it may be possible to manage portions of the L&YW stream through anaerobic digestion or co-digestion, or by producing a mulch product. The development of reusable "biocells" at landfill sites is another option that may become feasible over time.

Although it feels that the management method or technology should not be limited to composting, the Project Team was unanimous in its support of the concept of beneficial reuse. L&YW (and other organic wastes) have inherent characteristics that allow them to be converted into products that can be reused as soil amendments or as a substrate for physical or biological treatment. There is also the potential to capture the energy from L&YW in the form of biogas prior to their conversion to a soil amendment or treatment substrate.

As part of developing the details of a provincial program, it will likely be necessary to prepare a list of acceptable beneficial reuse options and opportunities. The following list of beneficial reuse opportunities is provided below as a starting point for consideration:

- Compost for erosion control and landscaping;

- Mulch for erosion control and landscaping;

- Use in intermediate and final cover systems at landfills as a biological treatment media for landfill gas;

- Use as part of growing media in final landfill cover systems;

- Use in green roof construction;

- Use as a biological treatment media for surface waters (e.g. bioswales, filter strips); and

- Use to reduce sediment loading in surface water run-off.

12.1.2 Differential Tipping Fees

Differential tipping fees are charged at waste processing and disposal facilities, and provide an economic incentive for source separation of materials. The fee structures can be set such that "good behaviour" (i.e. source separation) is rewarded by lower tipping fees, or poor behaviour (i.e. unsorted loads) is penalized by surcharges.

Since participation in source separation is voluntary, the implementation of a differential tipping fee structure does not affect a facility's ability to claim greenhouse gas offset credits; implementation of a provincial disposal ban would eliminate the ability of processors to claim offset credits. A provincial L&YW disposal ban may also impact the feasibility of installing landfill gas collection systems at larger landfills, and using the landfill gas to generate electricity.

One of the potential hurdles to implementing differential tipping fee structures in Alberta is the fact that disposal fees charged at some landfills are very low, and may not be reflective of full-cost accounting practices. Therefore, providing a reduced tipping fee for segregated loads of L&YW may put the processing facility/operation at a financial disadvantage.

In light of this, a surcharge-based approach, such as that adopted by City of Grande Prairie and the Francis Cooke Landfill is recommended, with surcharges in the order of 50% to 100% for MSW loads containing L&YW. Where disposal fees are reflective of full costs, and are higher than the full-costs of L&YW processing, reduced fees for segregated L&YW should also be considered. It is intended that the differential fee structure would be implemented individually by each disposal site, and would be coordinated, but separate from, the province-wide disposal levy implemented by Alberta Environment.

Logistically, the implementation of differential tipping fees should not create a significant additional burden on landfill operations. Many landfills already use differential fees to recognize the additional or reduced costs of handling special wastes (e.g. tires, CFC-containing appliances, clean fill, scrap metal). Most scale software packages allow for the setting of different tipping fees by material type.

12.1.3 Curbside Collection Programs

The ability of residents in urban centers to set out large volumes of L&YW for pickup in curbside collection programs remains one of the largest disincentives to reduction and source separation. By implementing one of several available changes to their collection programs (e.g. bag-limits, tag-a-bag, L&YW collection bans), municipalities can significantly increase the participation in L&YW diversion programs as well as other recycling programs.

Implementation these changes to curbside collection programs must be done in concert with the implementation (or possible expansion) of L&YW diversion infrastructure. In small and medium-sized urban centers, the development of drop-off depots is normally sufficient. In larger centers, the implementation of curbside L&YW collection programs (e.g. seasonal, full-season, or subscription-based) may be necessary to supplement drop-off sites.

12.1.4 Disposal Levy and L&YW Diversion Fund

The implementation of a disposal levy is seen as an equitable and sustainable means of funding L&YW reduction/diversion efforts and, if levies are remitted on a semi or annual basis, the accounting and administrative efforts involved are manageable. Furthermore, a levy approach does not penalize one type of waste generator at the expense of others (e.g. residential, commercial, institutional). Although this is not its primary intent, a disposal levy is also expected to provide a further economic incentive to minimize waste generation and participate in diversion programs.

The levy would be applied against municipal solid waste disposed of in Class II and III landfills. Municipal solid waste disposed of via reusable biocells, incineration/gasification facilities would be exempt from the levy, provided there is a verified form of energy recovery from the facility.

Oilfield wastes, agricultural waste, hazardous wastes, special wastes (e.g. asbestos, animal carcasses, biomedical wastes), contaminated soils, and clean fill used as daily or intermediate cover would be exempt from the levy. Similarly, materials collected at landfill sites but not disposed of (e.g. scrap metal, tires, e-waste, "clean" lumber) would also be exempt from the levy.

Each disposal facility would be required to have weigh-scales in place to allow for proper assessment and auditing of levies. Since the majority of disposal facilities have scales in place, this is not expected to be problematic. For those facilities that do not have scales, a site-specific program would need to be developed based on standardized volume measurements and density estimates.

Money collected through the levy should be deposited in a fund that is separate and "arms-length" from the Province's general revenue accounts. This is necessary to ensure that the levies can be suitably accounted for, and can be reinvested back into L&YW waste diversion efforts without being subjected to political considerations.

For similar reasons, the fund should be managed by a 3rd party that is independent of the Province. However, Alberta Environment as well as disposal facility owners/managers (private and public), municipalities, and organic waste processors should be advisors to the independent organization.

The financial mechanisms by which the levies are collected and managed/invested must meet generally accepted standards for accountability. Financial instruments and investments should also be shielded from the impacts of downturns in the economy, and bankruptcy or other failures of financial institutions.

Since the L&YW Diversion Fund would be based on levies on landfilled waste, and landfilling of waste is expected to be a reality in Alberta for at least the next ten to twenty years, the fund will be self sustaining during that period. However, it would likely be necessary for the Province to provide an initial "investment" or endowment to establish the fund and allow it and the 3rd party organization to operate effectively during the initial one to two year period as the program ramps up. The magnitude of this investment will be subject to the anticipated investment required in new programs and infrastructure to achieve the diversion goals set by the Province.

12.1.5 Education and Awareness Program and Resources

A portion of the diversion fund should be allocated to developing a series of education and awareness tools and resources that municipalities across the province can incorporate into their existing programs. This would help to ensure a consistent province-wide message, and provide municipalities with access to "higher end" and a more complete set of resources than they might otherwise not be able to produce on their own.

The education and awareness tools and resources could include fact sheets, brochures, stock photos, backyard composting manuals, presentations, and website content.

The materials should also be developed to target a range of audiences including residents, municipal operations, institutions, and the commercial sector (e.g. building operators, groundskeepers).

12.1.6 Market Development

Development and expansion of markets for beneficial products produced from L&YW (e.g. compost, mulch) is necessary to help further encourage the implementation and acceptance of diversion efforts.

Market development activities could potentially include a range of specific initiatives:

- Development and publishing of end product specifications;
- Working with producers on implementing site-specific product quality assurance programs, and promotion of industry-developed quality assurance programs (i.e. Compost Quality Alliance);
- Developing materials and providing training related to the technical aspects of product usage and sales;
- Resources and training for end users on product benefits and uses;
- Review/amending provincial government purchasing and engineering specifications to allow/promote greater use of products; and
- Work with staff in Alberta Environmental and other provincial government departments (e.g. Agriculture and Rural Development) to promote compost as a tool for managing soil moisture retention and soil erosion.

12.1.7 Operator Training on Best Management Practices

Alberta has led the country in the development of a Compost Facility Operator Certification Program. However, feedback from program participants indicates that there is a need for more accessible training opportunities in support of the program. A portion of the diversion fund should therefore be allocated to increasing access to training programs for municipal and private facility managers and operators.

12.1.8 L&YW Diversion Grant Program

A significant portion of the funds collected through the disposal levy should be used to provide financial support for the development and improvement of collection and processing infrastructure for L&YW generated by the residential, institutional and commercial sectors (i.e. those to which the levy was applied). Financial support would be provided in terms of grants to municipal and private organizations that collected and process L&YW from the municipal waste stream. Grant monies would not be provided to develop infrastructure for agricultural or oilfield wastes as these feedstocks fall outside of the levy system.

In order to maintain equality between those operations that have already invested in diversion infrastructure, and those who have not, grant funding would be distributed on the basis of verified results (i.e. tonnes of L&YW collected or tonnes of beneficial product produced and used). This approach requires that the municipality or private organizations make the initial financial commitment to the program being developed, which should help to ensure its long-term sustainability and stability. As the L&YW Diversion Fund grows and matures, it may be possible to offer low-interest loans, or partner with other agencies (e.g. Business Development Bank of Canada, Western Economic Diversification Canada) to assist with program startups.

It is critical that the allocation of grants recognize the differing contributions and requirements between regions within the province, and ensure funds are distributed in an equitable manner.

A detailed business case outlining the collection or processing proposal and its benefits would be required as part of the grant application process. A condition of the funding would be the adoption or continued use of best management practices, compliance with regulatory requirements, and mandatory annual reporting of program performance and L&YW quantities managed to Alberta Environment.

12.1.9 Reporting and Monitoring

Having the ability to monitor the effectiveness of the program in achieving diversion goals is a fundamental requirement. This would require a higher level of tracking and reporting of L&YW diversion activities by municipal and private sector organizations than is currently done. The tracking program and reporting of program effectiveness will have to take into account the year-to-year variations in L&YW generation caused by climatic influences.

Monitoring and reporting of activities by the 3rd party that manages the funds collected through a disposal levy is also a critical component. Auditing, reporting, and business planning requirements in place with existing Delegated Administrative Organizations (DAOs) can provide the basis of the requirements for the 3rd party that is given responsibility for the L&YW diversion fund and associated programming.

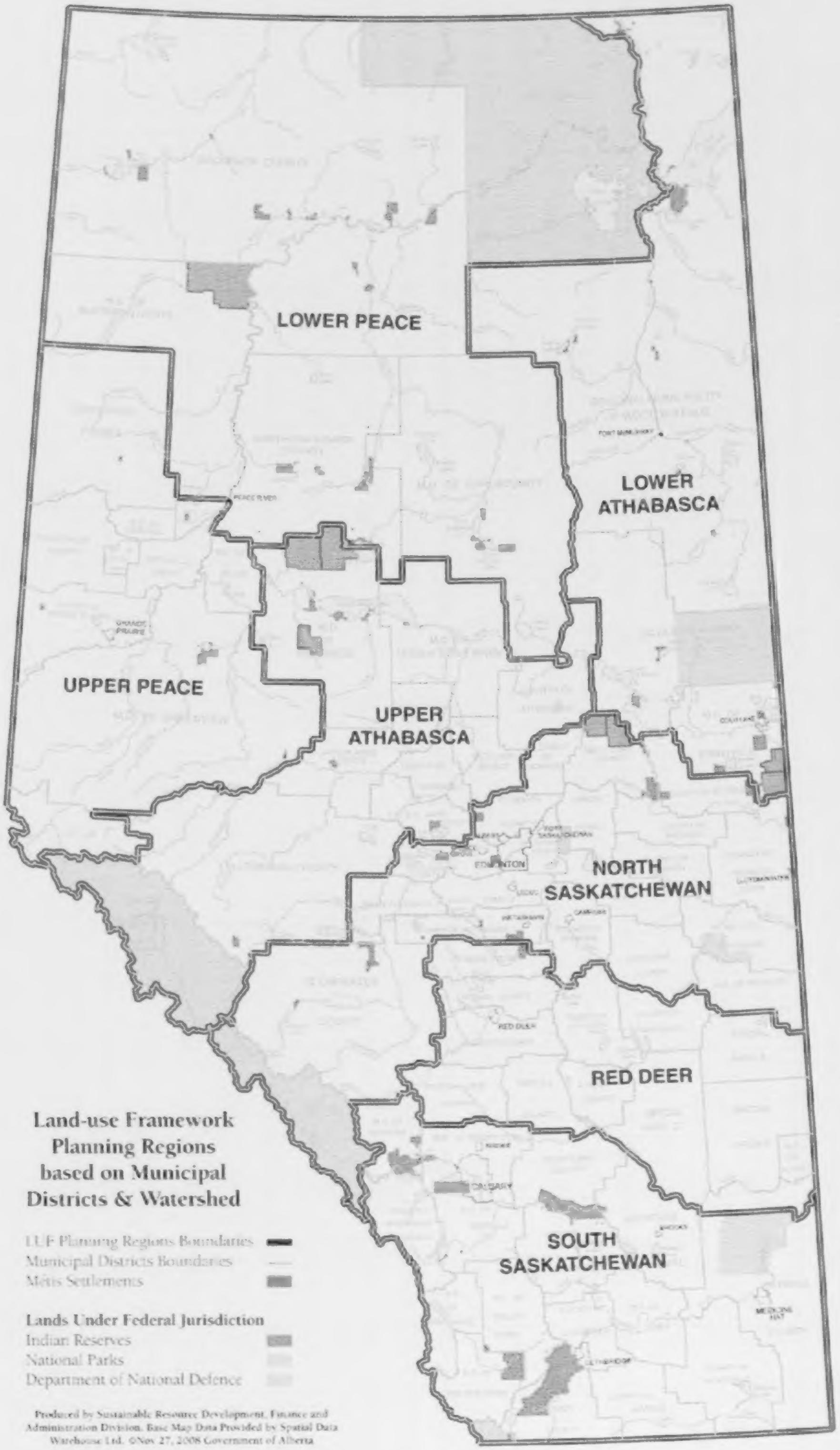
12.2 Diversion Targets

Based on the research conducted as part of this study and the experience of the Project Team, two sets of L&YW diversion targets have been developed for Alberta. The first set represents a modest level of diversion that could be achieved with coordinated action and support of the municipalities, and a low level of investment in infrastructure. The second goal is reflective of more aggressive diversion programs and higher participation rates, but also higher investment in collection and processing infrastructure.

A key factor that was taken into account in establishing these diversion targets is recognizing the difference in lifestyles between Alberta's rural and urban populations. Given their relative "remoteness" from infrastructure, rural residents living on farms, ranches, acreages are less likely to participate in L&YW diversion programs.

In light of this expected difference in participation between rural and urban residents, and also the differing commercial base in rural areas, diversion targets should be set on a regional basis. For the purposes of this study, the seven geographic regions shown in Exhibit 12-1 which form part of Alberta's Land Use Framework (LUF) have been used.

The program assumptions outlined in Exhibit 12-2 have been used as the basis for developing diversion targets. Exhibit 12-3 shows the estimated diversion potential on a regional basis.


LOWER PEACE
UPPER PEACE
LOWER ATHABASCA
UPPER ATHABASCA
NORTH SASKATCHEWAN
RED DEER
SOUTH SASKATCHEWAN
PEACE RIVER
GRANDE PRAIRIE
FORT McMURRAY
EDMONTON
RED DEER
CALGARY
LETHBRIDGE
MEDICINE HAT
Land-use Framework Planning Regions based on Municipal Districts & Watershed
LUF Planning Regions Boundaries
Municipal Districts Boundaries
Métis Settlements
Lands Under Federal Jurisdiction
Indian Reserves
National Parks
Department of National Defence

Produced by Sustainable Resource Development, Finance and Administration Division. Base Map Data Provided by Spatial Data Warehouse Ltd. ©Nov 27, 2008 Government of Alberta

EXHIBIT 12-1
LAND-USE FRAMEWORK PLANNING REGIONS

EXHIBIT 12-2

L&YW DIVERSION PROGRAM ASSUMPTIONS

Modest Diversion Target	Aggressive Diversion Target
• No significant participation by rural residents. • Collection programs in small and medium sized urban centres would consist of drop-off depots with a diversion rate of 15%. • Collection programs for residents in large urban centers would consist of seasonal curbside collection (i.e. spring and fall). A diversion rate of 50% has been assumed. • Minimal participation by ICI generators in drop-off programs.	• No significant participation by rural residents. • Extensive promotion of L&YW reduction practices (e.g. grasscycling, backyard compost). • Municipalities would incorporate some form of limits into curbside collection programs to encourage participation in L&YW diversion programs. • Collection programs in small urban centres limited to drop-off depots with an assumed diversion of 40%. • A combination of seasonal (i.e. spring & fall) curbside collection and depot programs would be implemented in medium–sized urban centres. A diversion rate of 60% has been assumed. • Combination of full-season (i.e. May through October) curbside collection and depot programs in large urban centres. A diversion rate of 80% has been assumed. • ICI generators in all urban centres would be actively encouraged to participate in drop-off programs.

12.3 Impact of GHG Offset Credits of Grant Funding

Overall, the potential financial value of offset credits resulting from the composting of L&YW materials is substantial; estimates prepared as part of this study put the upper limit at over $7 million per year based on a trading value of $11.75 per tonne CO_2e.

However, this value is somewhat "theoretical" as it is based on 100% diversion of L&YW, and is also based on several assumptions relating to baseline emissions from landfills, the amount of residuals resulting from L&YW composting process, and the type and fuel consumption rate of site equipment. In reality, the amount of L&YW that can realistically be diverted, baseline conditions, and equipment operating practices will vary from facility to facility, and the tonnes of to CO_2e credits will be less.

Revenues from offset credits must also be tempered by the costs of quantification and verification, and fluctuations in the trading value of credits. At this point there is very little actual experience with the trading of offset credits from composting facilities in Alberta; only the City of Edmonton has completed the quantification and verification process and successfully traded credits, and two other facilities (Clean-it Green-it and City of Medicine Hat) are in the midst of the quantification/verification process.

EXHIBIT 12-3
SUMMARY OF L&YW DIVERSION TARGETS BY GEOGRAPHIC REGION [1]

Region	Total L&YW Quantities(tpy)	Estimated L&YW Quantities Being Processed	L&YW Quantities Urban Centers (tpy)	Modest Diversion Target	Aggressive Diversion Target
	(tpy)	**(tpy)**	**(tpy)**	**(tpy)**	**(tpy)**
North Saskatchewan	192,228	99,046	174,354	68,100	112,000
South Saskatchewan	250,501	13,289	240,075	94,100	154,000
Red Deer	21,973	13,840 [2]	13,196	3,100	6,500
Lower Athabasca	9,095	5,720	6,374	2,300	3,600
Upper Athabasca	11,225	600	4,744	500	2,000
Lower Peace	3,976	55	1,379	100	400
Upper Peace	9,679	0	5,040	1,400	2,500
Total	**498,677**	**132,580**	**445,162**	**169,600**	**281,000**
	% of Province-wide L&YW generation			34%	56%
	% of Urban Centre L&YW generation			38%	63%

Notes:

1. Does not reflect changes in quantities/targets resulting from population growth.
2. Includes material being processed at the Bowden Institute which has been slated for closure by the Federal Government.

Another complicating factor that may affect the amount of GHG offset credits that will be claimed is the size of composting facilities. To date, most Alberta facilities are small (i.e. <2,500 tonnes per year), and the financial feasibility quantifying/verifying and claiming credits from these facilities may be marginal. The potential exists for several facilities to group together and share costs associated with quantification/verification and trading, but further upfront work on aggregation protocols would be required to put a system in place.

In light of these various considerations, it is recommended that the impact of GHG offset credits not be considered in the setting of disposal levies and the granting of funds to processing facilities.

12.4 L&YW Diversion Fund Size

As outlined previously, the required size of the L&YW Diversion fund would be subject to the anticipated investment required in new programs and infrastructure to achieve the diversion goals set by the Province.

A means of estimating the magnitude of fund size required, a review of existing infrastructure relative to the distribution of urban centres and L&YW quantities was undertaken. Based on this review, a conceptual network of new/upgraded processing facilities and drop-off points necessary to support the aggressive diversion target (i.e. Exhibit 12-3) was identified for each of the seven LUF regions. For the purposes of developing the conceptual networks, urban centres with populations of less than 1,000 were not considered unless existing infrastructure existed or they were geographically significant. First Nations and Metis communities were also not included in the review since infrastructure development in these communities is a federal responsibility.

A summary of the conceptual infrastructure requirements (excluding curbside collection program requirements) and estimated order-of-magnitude development costs on a regional basis are provided in Exhibit 12-4. A detailed listing of regional infrastructure development and cost assumpations are provided in the appendices.

EXHIBIT 12-4

SUMMARY OF CONCEPTUAL L&YW INFRASTRUCTURE REQUIREMENTS BY GEOGRAPHIC REGION

Region	Drop-off/Transfer Sites	New Class 3 Facilities	New Class 2 Facilities	Upgrades/ Expansion of Existing Facilities
North Saskatchewan				
Number	26	5	1	10
Est. Capital Cost	$195,000	$300,000	$175,000	$1,260,000
South Saskatchewan				
Number	24	4	0	6
Est. Capital Cost	$180,000	$250,000		$17,400,000
Red Deer				
Number	10	3	0	10
Est. Capital Cost	$75,000	$100,000		$1,575,000
Lower Athabasca				
Number	0	2	0	2
Est. Capital Cost		$150,000		$875,000
Upper Athabasca				
Number	1	7	0	4
Est. Capital Cost	$7,500	$575,000		$250,000
Lower Peace				
Number	0	3	0	1
Est. Capital Cost		$125,000		$75,000
Upper Peace				
Number	5	7	0	1
Est. Capital Cost	$37,500	$350,000		$500,000
Province-Wide Total				
Number	**64**	**31**	**1**	**31**
Est. Capital Cost	**$495,000**	**$1,850,000**	**$175,000**	**$21,935,000**
Overall Total				**$24,445,000**

In addition to development requirements, funding would be needed to support the development of education and awareness programs and materials, market development initiatives, and training programs. Management of these programs and collection/management of the levy would further result in a "program administration cost". The annual costs of these activities are estimated to be in the order of $750,000 per year, the majority of which is associated with staff wages.

If the full amount these infrastructure costs were to be offset by a disposal levy system over a five year period, the levy amount (based on the generation of 3,500,000 tonnes of municipal solid waste per year) would be in the order of $2 per tonne. Similarly, if the full costs of processing operations were factored in (at an assumed average processing cost of $35/tonne) the levy amount would have to increase to approximately $4.50 per tonne in order for the fund to be self sustaining beyond a ten year period. (A high-level proforma showing the above described funding program is provided in the appendices.)

Logistically, it would not be possible for the program to be implemented without considerable "front-end" work related to the establishment of the levy mechanism and the formation of the 3rd party organization to manage the program. Therefore, an endowment or investment into the program by the Province would be needed. This seed money would be used to establish and sustain the activities of the 3rd party organization for a one to three year period until disposal levies are remitted and the L&YW Diversion Fund becomes self sustaining.

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APPENDIX A

DRAFT STANDARD FOR COMPOSTING FACILITIES IN ALBERTA

STANDARDS FOR

COMPOSTING FACILITIES IN ALBERTA

Alberta Environment
Environmental Assurance
Environmental Policy Branch

July 2007

Alberta
Environment

FOREWORD

Until the updated regulatory revisions are legislated, these *Standards* will only apply to new composting facilities or lateral expansions as required by the Director issuing approvals or reviewing applications for registration. It is expected that those responsible for composting facilities, including consultants, will use the *Standards* to prepare approval and registration applications and improve composting facility design, operation, and closure measures.

Existing composting facilities operating under an approval or registration shall follow the conditions of their approval or registration. However, facility owners and operators should begin updating their operations plan, monitoring plans, and other requirements of the *Standards* in preparation for legislation changes.

The use of the standards does not absolve a composting facility owner from Alberta Environment or other ministries regulatory requirements. The composting facility owner should consult agencies such as the local development authority, the Energy and Utilities Board if accepting oilfield wastes, and Federal Ministries such as Environment Canada to determine other applicable regulatory requirements.

Any comments or concerns with the content of the Standards should be submitted in writing to:

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Alberta Environment
10th Floor Oxbridge Place
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INTRODUCTION

Alberta Environment is updating its waste management regulatory requirements. The *Standards for Class II & Class III Composting Facilities in Alberta* (*Standards*) is one initiative in upgrading waste management regulatory requirements. The *Standards* outline the minimum requirements for development, operation, monitoring, and closure of a Class II & Class III composting facility.

These standards were built on the following outcomes:

Alberta's composting facilities are designed, constructed, operated and closed in a manner that is protective of air, land, water, biodiversity, human health, and human quality of life.

Facilities will meet local land use planning requirements, and not create a risk to the local community.

Compost quality meets minimum requirements to not adversely affect the land, plants, or crops.

These standards outline the requirements for Class II and Class III composting facilities. Persons responsible for composting facilities affected by these standards should consult with Alberta Environmental prior to commencing the construction and operation of a composting facility.

The classifications for composting facilities are as follows:

Class I composting facilities are facilities that accept more than 20,000 tonnes of feedstock per year. Persons responsible for Class I composting facilities should contact Alberta Environmental for more information regarding regulatory requirements.

Class II composting facilities are facilities that accept 500 to 20,000 tonnes of leaf and yard waste feedstock per year, or up to 20,000 tonnes of feedstock per year. Acceptable feedstock for Class II facilities includes: animal bedding, brewery/winery waste, cardboard and paper products, food waste, manure, milk processing waste, paunch manure, hatchery waste, source separated organics, wastewater sludge, and vegetative matter. Additional feedstock may be received at a Class II facility, pending approval by Alberta Environment.

Class III composting facilities are facilities that accept 100 to 500 tonnes of leaf and yard waste feedstock per year.

These standards do not apply to composting facilities accepting less than 100 tonnes per year of leaf and yard waste.

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DEFINITIONS

For the purposes of these Standards,

(a) "Act" means the *Environmental Protection and Enhancement Act.*, R.S.A. 2000 c. E-12, as amended;

(b) "Active Composting Area" means the area where windrows or piles of feedstock are placed for active composting;

(c) "Aerobic conditions" means an environment which is conducive to the microbial degradation of organic solid waste in the presence of oxygen

(d) "Amendments" means a supplemental material mixed with compostable feedstock in preparation for composting to create a favorable condition for composting, either by adjusting the moisture content, or the carbon to nitrogen ratio;

(e) "Animal bedding" is absorbent material that is used for covering the floor of livestock confinement areas, and includes straw, wood shavings, and associated manure and urine;

(f) "Animal Mortality" means a deceased animal, not including hatchery waste

(g) "Animal Part" means any part of an animal that is not food waste or hatchery waste;

(h) "Background groundwater quality" means the groundwater quality prior to the start of composting operations;

(i) "Brewery/winery waste" means non-hazardous organic waste from beer and wine manufacturing. This includes materials such as: spent grain, yeast, and grape marc;

(j) "Bulking agent" means a material that is added to compostable feedstock to enhance porosity and airflow;

(k) "CCME" means the Canadian Council of Ministers for the Environment;

(l) "Class I composting facility" means a waste management facility which accepts 20,000 tonnes or more per year of feedstock for composting, for composting, but does not include:
  a. a residential composter, or
  b. a manure storage facility as defined in the *Agricultural Operation Practices Act*;

(m) "Class II Composting Facility" means a waste management facility that accepts under 20,000 tonnes /yr wet weight of feedstocks for composting, but does not include
  a. a residential composter;
  b. a Class I composting facility;
  c. a Class III composting facility; or,
  d. a manure storage facility as defined in the *Agricultural Operation Practices Act*.

(n) "Class III Composting Facility" means a waste management facility accepting between 100 and 500 tonnes per year of leaf and yard waste feedstock for composting, but does not include
  a. a residential composter;
  b. a Class I composting facility;
  c. a Class II composting facility; or,
  d. a manure storage facility as defined in the *Agricultural Operation Practices Act*.

(o) "Certified Operator" means a person who holds qualifications recognized by the Director;

(p) "Compost" is a solid mature product resulting from composting;

(q) "Composting" is a managed process of bio-oxidation of a solid heterogeneous organic substrate including a thermophilic phase;

(r) "Contaminant" means a substance that is present in an environmental medium in excess of natural background;

(s) "Curing Area" means the area where composting materials are placed to stabilize to reach maturity;

(t) "Day" means any period of 24 consecutive hours unless otherwise specified;

(u) "Design Capacity" means the processing capacity of the composting facility in tonnes (w/wt) of feedstock accepted per year;

(v) "Expanding Facility" means a facility that applies to increase the registered design capacity;

(w) "Feedstock" means all materials that are accepted at the composting facility and used in the composting process, including amendments and bulking agents;

(x) "Feedstock Preparation Area" means the area where feedstocks are temporarily placed for processing prior to active composting;

(y) "Food waste" means food and food preparation wastes from residences and commercial establishments such as grocery stores, restaurants, produce stands, institutional cafeterias and kitchens, and industrial sources like employee lunchrooms;

(z) "Foreign matter" means any matter over 2mm in dimension that results from human intervention and has organic or inorganic components such as metal, glass, synthetic polymers (for example plastic and rubber) and that may be present in the compost including metal, glass, plastic, rubber and other synthetic polymers, but excluding mineral soil, woody material and pieces of rock;

(aa) "Final Closure" means the period after all feedstock acceptance has ceased;

(bb) "Groundwater" means all water under the surface of the ground whether in liquid or solid state;

(cc) "Groundwater contamination" is defined as a change in water quality that produces a noticeable or measurable change in groundwater characteristics;

(dd) "Hatchery waste" means broken or unhatched eggs, unhatched chicks, membranes, embryonic fluids and egg shell;

(ee) "Hydraulic conductivity" means the ease with which a fluid can be transported through a material;

(ff) "ISO 17025" means the international standard, developed and published by International Organization for Standardization (ISO), specifying the management and technical requirements for laboratories;

(gg) "Leaf and yard waste" means vegetative matter resulting from gardening, horticulture, agriculture, landscaping or land clearing operation, including materials such as tree and shrub trimmings, plant remains, grass clippings, leaves, trees and stumps;

(hh) "Liner" means a continuous layer constructed of natural or man made materials, beneath or on the sides of a structure or facility, which restricts the downward or lateral migration of the contents of the structure or facility;

(ii) "Mature compost" means a stable compost that has little or no organic phytotoxic substances that can cause delayed seed germination when used as a soil amendment, and meets maturity compost quality requirements, as set out in the Guidelines for Compost Quality, published by CCME, as amended;

(jj) "Manure" means excreta in liquid or solid form from livestock, poultry, pets, animals in zoological facilities, and aquaculture;

(kk) "Manure storage facility" means a manure storage facility as defined in the *Agricultural Operation Practices Act*;

(ll) "Milk processing waste" means sludge or biomass from treatment of milk or fluid milk;

(mm) "Monitoring well" means a well drilled at a site to measure groundwater levels and collect groundwater samples for the purpose of physical, chemical, or biological analysis to determine the concentration of groundwater contaminants;

(nn) "Natural protective layer" means a continuous layer of natural materials, beneath or on the sides of a structure or facility, which restricts the downward or lateral migration of the contents of the structure or facility;

(oo) "Pathogens" means organisms, including some bacteria, viruses, fungi, and parasites, that are capable of producing an infection or disease in a susceptible human, animal or plant host;

(pp) "Paunch manure" means undigested stomach contents of ruminants;

(qq) "Positive slope" means a slope that encourages positive drainage of water and minimizes ponding;

(rr) "Process water" means a combination of storm water run-on, leachate, equipment wash down water and any other wastewater generated on site;

(ss) "Processing area" means the combination of the feedstock processing and the active composting area;

(tt) "Receiving area" means the area used to receive incoming feedstocks;

(uu) "Registered Design Capacity" is the design capacity that has been registered with Alberta Environment;

(vv) "Retention Pond" means a pond that is designed to store process water and run-off from storm events;

(ww) "Run-off" means any rainwater or meltwater that drains as surface flow from the receiving, processing, curing and associated storage areas of a compost facility;

(xx) "Run-on" means any rainwater or meltwater that drains as surface flow onto the receiving, processing, curing and associated areas of a compost facility;

(yy) "Sharp foreign matter" means any foreign matter over 3mm dimension that may cause damage or injury to humans and animals during or resulting from its intended use, and may consist of, but is not limited to the following: metallic objects or pieces thereof; glass or porcelain or pieces thereof;

(zz) "Source separated organics" means the organic fraction of municipal solid waste, that has been accumulated and presorted by the generator, and collected separately from household hazardous material and non-compostable material;

(aaa) "Spring" means an area where groundwater flows naturally onto the earth's surface at an identified location;

(bbb) "Storage area" means the area used to store mature compost;

(ccc) "Storage capacity" means the storage area size that is capable of storing one year's worth of compost production for a period of eight months;

(ddd) "Subsoil" means the layer of soil directly below the topsoil, to a maximum depth of 1.2 metres below the topsoil surface, that consists of the B and C horizons as defined in The System of Soil Classification for Canada, Agriculture and Agri-Food Canada, 1998, Publication 1643, 3rd Edition, as amended or replaced from time to time;

(eee) "Topsoil" means the uppermost layers of soil that consist of the L, F, H, O, and A horizons as defined in The System of Soil Classification for Canada, Agriculture and Agri-Food Canada, 1998, Publication 1643, 3rd Edition, as amended or replaced from time to time;

(fff) "Trace elements" are chemical elements present in compost at a very low concentration;

(ggg) "Wastewater sludge" means the accumulated wet or dry solids that are separated from wastewater during treatment, including the precipitate resulting from the chemical or biological treatment of wastewater;

(hhh) "Water body" means a water body as defined in the *Water Act*.

(iii) "Water table" means the upper level of groundwater: the level below which the pore spaces in the soil or rock are saturated with water;

(jjj) "Water well" means an opening in the ground, whether drilled or altered from its natural state, that is used:

a. for the production of groundwater for any purpose;
b. obtaining data on groundwater; or
c. recharging an underground formation from which groundwater can be recovered, and includes any related equipment, buildings, structures and appurtenances;

(kkk) "Working surface" means a surface that can withstand the wear and tear of composting equipment and forms the base of the receiving, feedstock preparation, active composting, screening, and curing areas of a composting facility;

(lll) "Vegetative matter" means source-separated organics that consist of plant matter, including but not limited to non-treated wooden material, leaf and yard waste, agricultural crop residues, vegetable processing plants, and pre-consumer meat-free food wastes;

(mmm) "Year" means a calendar year.

CLASS II COMPOSTING FACILITIES

1. Registration

1.1. Registration Application

In addition to any information required by the Director under the Approvals and Registration Procedure Regulation (A.R. 113/93), an application for registration of a newly proposed or an expanding composting facility shall contain at a minimum the following documents:

a) a registration application form;
b) a composting facility checklist;
c) a facility design plan and specifications;
d) a topsoil stockpile plan;
e) an operations plan;
f) an odour management program;
g) a groundwater monitoring program; and
h) a background groundwater quality report.

1.2. Facility Design Plan and Specifications

(a) Unless authorized in writing by the Director, the Facility Design Plan and Specifications shall be prepared by a professional registered with the Association of Professional Engineers, Geologists, and Geophysicists of Alberta (APEGGA).

(b) The Facility Design Plan and Specifications shall include, as a minimum, all of the following:

(i) An engineering design report that provides a description of proposed:
  a. feedstocks;
  b. composting methods;
  c. design capacity, including:
    i. processing area capacity;
    ii. storage area capacity; and
    iii. curing area capacity.
  d. environmental control measures included in the design; and
  e. monitoring systems.

(ii) Engineering maps and plans that include:
  a. soils investigation report;
  b. topographic site plans showing the overall site development and setbacks;
  c. cross-sections showing based grades and elevations;
  d. a description and interpretation of groundwater elevations, flow, patterns and composition;
  e. details of components of the composting facility;
  f. a design for liner for receiving areas, feedstock storage, active composting areas, curing areas, and process water retention ponds;
  g. a working surface that has a positive slope and capable of withstanding wear through normal operations;
  h. a run-on control system to prevent flow of water onto developed areas of the composting facility for events of up to

at least the peak discharge from a 1 in 25 year – 24 hour duration storm event;

- i. run-off control system to collect and control the volume of process water run-off for a 1 in 25 year – 24 hour duration storm event; and
- j. a groundwater monitoring system, unless authorized in writing by the Director.

(iii) Soil Conservation Plan, that includes:

- a. provisions to conserve all topsoil and subsoil for reclamation;
- b. the location of the stockpiles;
- c. the content of the stockpiles;
- d. the volume of the stockpiles; and
- e. provisions to stockpile the soil as follows:
  - i. to locate all soil stockpiles at the facility;
  - ii. on stable foundations; and
  - iii. on undisturbed topsoil.

1.3. Operations Plan

The Operations Plan shall include, at a minimum, the following:

- (a) a list of feedstock accepted at the composting facility;
- (b) feedstock acceptance policies and procedures;
- (c) prohibited waste handling procedures;
- (d) site security and public access control procedures;
- (e) working surface maintenance program;
- (f) liner maintenance program;
- (g) a composting process plan, including:
  - (i) a description of composting technology used;
  - (ii) procedures for maintaining aerobic conditions;
  - (iii) a pathogens reduction plan;
  - (iv) a composting temperature monitoring program;
  - (v) quality assurance and quality control program;
  - (vi) procedures for curing compost to meet maturity requirements;
  - (vii) procedures for storage and management of final product; and
  - (viii) procedures for preventing pathogen re-growth in final product;
- (h) an odour management program;
- (i) process water management procedures;
- (j) environmental monitoring program;
- (k) compost quality monitoring plan;
- (l) procedures for handling and disposal of residual materials;
- (m) a site safety and emergency response plan;
- (n) contingency plan for reasonably foreseeable events;
- (o) nuisance management plan; and
- (p) reporting procedures.

1.4. Odour Management Program

The Odour Management Program shall include all the following components:

- (a) a description of odour control technology;
- (b) best management practices to mitigate offensive odours;
- (c) a method to detect odours;
- (d) a procedure to track and document public complaints regarding odours from the composting facility;

(e) a procedure to respond to public complaints regarding odours originating from the composting facility; and
(f) an odour contingency response plan to minimize or remedy offensive odours.

1.5. Groundwater Monitoring Program

Unless authorized in writing by the Director, the groundwater monitoring program shall include, at a minimum, the following:

(a) a program to establish background groundwater quality prior to the start of composting operations;
(b) a detailed program for groundwater sample collection and analysis, that includes, at a minimum, the following:
  (i) retrieval of representative samples from each groundwater monitoring well at least once per year;
  (ii) laboratory analysis of the samples for parameters as set out in Table 1; and
  (iii) monitoring the depth to water at each monitoring well at time of sampling.

TABLE 1
Groundwater Parameters for Routine Monitoring

Dissolved Metals
Arsenic
Barium
Boron
Cadmium
Chromium
Copper
Iron
Lead
Manganese
Mercury
Vanadium
Other Parameters
Total phosphorus
Ammonia
Nitrate-Nitrogen
Total Kjeldahl Nitrogen
pH
Total dissolved solids
Electrical conductivity
Chemical oxygen demand
Total organic carbon
Calcium
Magnesium
Sodium
Potassium
Chloride
Sulphate
E. coli
Total coliform

1.6. Background groundwater quality report

A background groundwater quality report shall include analysis of:

(a) routine groundwater chemistry;
(b) trace elements;
(c) total coliform, fecal coliform, and *E. coli*; and
(d) the Director may, by notice in writing, require the registration holder to test additional background groundwater parameters.

2. Environmental Setbacks

Unless authorized in writing by the Director, no person shall construct or operate a composting facility within any of the following distances:

(a) within 100 metres from a spring;
(b) within 100 metres from a water well; and
(c) within 30 metres from a water body.

3. Construction Specifications

3.1. Facility Construction

(a) The construction of the composting facility shall comply with the Design Plan and Specifications.

(b) Any deviations from the construction requirements outlined in 3.2 through 3.3 must be authorized in writing by the Director.

3.2. Liner System

(a) The liner system included in the Design Plan and Specifications shall include, as a minimum, the following construction criteria:
  (i) the liner system must be placed under all active areas of the facility, including the receiving, feedstock preparation, active composting, and curing areas;
  (ii) the liner system must have a separation of at least 1 metre between the seasonally high water table and the bottom of the liner;
  (iii) the liner system must have a positive slope to avoid ponding; and
  (iv) the liner system must be constructed of a clayey material:
    a. with a thickness of at least 0.5 metres measured perpendicular to the liner surface; and
    b. with a hydraulic conductivity of 1×10^{-9} m/sec or less

  or alternative material that provides equivalent protection.

(b) Not withstanding 3.2 (a) the liner system shall be comprised of a natural protective layer only where all the following conditions are met:
  (i) the liner system prevents the lateral movement and downward migration of process water;
  (ii) the natural protective layer is comprised of 2 metres or more of a material that has a hydraulic conductivity of 1×10^{-8} m/sec or less;
  (iii) there is at least 1 metre of a material between the bottom of natural protective layer and the seasonally high groundwater table; and
  (iv) the natural protective layer has a positive slope to avoid ponding.

3.3. Retention Pond Liner

(a) The retention pond liner included in the Design Plan and Specifications must include, as a minimum, the following construction criteria:
  (i) a separation of at least 1 metre between the seasonally high water table and the bottom of the liner; and
  (ii) construction of a clayey material:
    a. with a thickness of at least 1 metre measured perpendicular to the liner surface, and
    b. that has a hydraulic conductivity of 1×10^{-9} m/sec or less
  or alternative material that provides equivalent protection..

(b) Notwithstanding 3.3 (a), the retention pond liner shall be constructed of a natural protective layer only where all the following conditions are met:
  (i) the retention pond liner prevents the lateral movement and downward migration of process water;
  (ii) there is 5 metres or more of a clayey material that has a hydraulic conductivity of 1×10^{-8} m/sec or less; and,
  (iii) there is at least 1 metre of a clayey material between the bottom of natural protective layer and the seasonally high groundwater table.

3.4. Groundwater Monitoring System

(a) Unless authorized in writing by the Director, the registration holder shall install a groundwater monitoring system for the composting facility.

(b) The groundwater monitoring system for the composting facility shall consist of
  (i) at least one monitoring well up gradient of the facility;
  (ii) at least two monitoring wells down gradient of the facility; and
  (iii) a type of well that is appropriate to monitor for contaminants.

3.5. Soil Conservation Plan

The registration holder shall:
(a) stockpile soil according to the soil conservation plan;
(b) take all steps necessary to prevent erosion, including but not limited to, all of the following:
  (i) revegetating the stockpiles; and
  (ii) any other steps as authorized in writing by the Director.
(c) immediately suspend conservation of soil when wet or frozen field conditions will result in mixing, loss or degradation of soil; and
(d) recommence conservation of soil only when wet or frozen field conditions in 3.4 (d) no longer exist.

4. Facilities Operations

4.1. Facility Maintenance

The registration holder shall maintain the composting facility to comply with the Design Plan and Specifications.

4.2. Certified Operator

The day to day operations of a Class II composting facility shall be supervised by a Certified Operator in accordance with the Waste Control Regulation, as amended.

4.3. Signage

The registration holder shall
(a) post; and,
(b) maintain
signs at the composting facility entrance providing, at a minimum, the following information:
  (i) name of registration holder or person responsible;
  (ii) telephone numbers for:
    a. 24hr emergency contact;
    b. the local fire department; and
    c. Alberta Environment (1-800-222-6514); and,
  (iii) hours of operation.

4.4. Feedstock list

Unless authorized in writing by the Director, the registration holder shall accept only the following feedstock for composting:
(a) animal bedding;
(b) brewery/winery waste;
(c) cardboard and paper products;
(d) food waste;
(e) hatchery waste;
(f) manure;
(g) milk processing waste;
(h) paunch manure;
(i) source separated organics;
(j) wastewater sludge; and
(k) vegetative matter, including those derived from processing plants.

4.5. Operations Plan

The registration holder shall:
(a) implement; and
(b) update
the Operations Plan in compliance with the composting facility Design Plan and Specifications, as specified in section 1.3.

4.6. Odour Management Program

The registration holder shall:
(a) implement; and
(b) update
an Odour Management Program.

4.7. Odour Complaints

Upon receiving a complaint regarding an offensive odour allegedly resulting from the composting facility, the registration holder shall:
(a) investigate the complaint;
(b) record the following information regarding the complaint:
  (i) the place, date and time of the complaint;

  - (ii) the name, and address of the complainant;
  - (iii) the nature of the complaint; and
  - (iv) a summary of all measures and actions that were taken to address the complaint.

4.8. Offensive Odours

Upon discovery of an offensive odour resulting from the composting facility, the registration holder shall:

- (a) implement the Odour Contingency Response Plan, which shall include:
  - (i) procedures to minimize or remedy the cause of the offensive odour, which may include:
    - a. monitor, measure, contain, remove, destroy or otherwise dispose of the substance or thing causing the offensive odour or control or prevent the offensive odour from occurring again;
    - b. install, replace or alter any equipment or thing in order to control or eliminate the offensive odour;
    - c. construct, improve, extend or enlarge the facility, structure or thing if that is necessary to control or eliminate the offensive odour; or
    - d. mitigate the odour in accordance with the Odour Management Program;
- (b) record the:
  - (i) date of the occurrence of the offensive odour;
  - (ii) actions done to minimize or remedy the offensive odour; and
- (c) take any action deemed necessary by the Director, in addition to any other duties imposed under the Act or the regulations under the Act.

4.9. Facility capacity

(a) The amount of feedstock accepted each year to a composting facility must not at any time exceed the registered design capacity of the facility.

(b) The registration holder must not, at any time, exceed the registered compost curing area and storage capacity area.

4.10. Nuisance Management

The registration holder shall control nuisances such as, but not limited too, litter, fires, disease vectors, and dust, by:

- (a) establishing and maintaining litter controls that include:
  - (i) minimize the escape of litter from the composting facility;
  - (ii) implementing controls to prevent litter to be washed, blown, or transported onto adjacent properties; and
  - (iii) retrieving litter that has been washed, blown, or transported onto adjacent properties, provided the consent of the owner of the adjacent property is first obtained.
- (b) managing the feedstock storage and the composting process to minimize disease vectors;
- (c) applying weed controls to prevent accumulation of weeds at the facility and in compost products;
- (d) managing feedstock storage and composting process to prevent the occurrence of fires; and

(e) set up or construct artificial barriers, utilizing natural barriers, or other effective measures to control access to the site to prevent the uncontrolled depositing of wastes or other materials.

5. Environmental Monitoring Standards

5.1. Sampling and Analytical Standards

(a) With respect to any sample required to be taken pursuant to these standards, all samples shall be:
  (i) collected;
  (ii) preserved;
  (iii) stored;
  (iv) handled; and
  (v) analyzed

in accordance with:

  (vi) the *Standard Methods for the Examination of Water and Wastewater*, published jointly by the American Public Health Association, American Water Works Association, and the Water Environment Federation, 1998, as amended; or
  (vii) the *Methods Manual for Chemical Analysis of Water and Wastes*, Alberta Environmental Centre, Vegreville, Alberta, 1996, AECV96-M1 as amended; or
  (viii) the *Guidelines for Compost Quality*, published by the CCME, as amended; or
  (ix) The *Test Methods for the Examination of Composting and Composts*, published by the United States Department of Agriculture and the United States Composting Council, as amended; or
  (x) a method authorized in writing by the Director.

(b) The registration holder shall analyze all samples that are required to be obtained by these standards in a laboratory accredited pursuant to ISO 17025 standard, as amended, for the specific parameter(s) to be analyzed, unless otherwise authorized in writing by the Director.

(c) The term sample as used in 5.1(b) does not include samples directed to continuous monitoring equipment, unless specifically required in writing by the Director.

(d) The registration holder shall comply with the terms and conditions of any written authorization issued by the Director under 5.1(b).

5.2. Groundwater Monitoring Program

(a) Unless otherwise authorized in writing by the Director, the registration holder shall
  (i) implement; and
  (ii) maintain;
a groundwater monitoring program.

(b) Unless otherwise authorized in writing by the Director the registration holder shall ensure that each groundwater monitoring well is:

- (i) protected from damage; and
- (ii) locked, except when samples are taken.

(c) If a groundwater sample cannot be collected because the monitoring well is damaged or is no longer capable of producing a representative sample

- (i) the groundwater monitoring well shall be cleaned, repaired or replaced; and
- (ii) a representative groundwater sample shall be collected prior to the next scheduled sampling date, unless otherwise authorized in writing by the Director.

(d) If at any time throughout the operational and final closure period groundwater contamination occurs at the composting facility, the registration holder shall:

- (i) immediately notify the Director in accordance with the Act and the regulations under the Act,
- (ii) identification of the source that is adding contaminant mass to the groundwater;
- (iii) remove or control of the source to prevent further contamination;
- (iv) construct, repair, or replace the structure or thing, if that is necessary, to prevent further contamination;
- (v) conduct additional groundwater monitoring; and
- (vi) any other duties imposed under the Act or the regulations under the Act.

(e) Throughout the operational and final closure period of the composting facility, the groundwater quality at each of the monitoring wells shall not exceed the numerical criteria published in Table 3 of the *Alberta Tier 1 Soil and Groundwater Remediation Guidelines*, published by Alberta Environment, as amended, unless otherwise authorized in writing by the Director.

5.3. Process Water Disposal Procedures

Process water from the retention pond shall be disposed of only in the following manner:

- (a) at an Alberta Environment approved wastewater treatment facility;
- (b) by irrigation in accordance with the safe limits "Guidelines for Municipal Wastewater Irrigation" published by Alberta Environment, as amended; or,
- (c) as otherwise authorized in writing by the Director

5.4. Retention Pond Sediments

Retention pond sediments shall be disposed of only in the following manner:

- (a) At an Alberta Environment approved waste management facility authorized to accept such waste;
- (b) by land application in accordance with "Guidelines for the Application of Municipal Wastewater Sludges to Agricultural Lands", published by Alberta Environment, as amended; or,
- (c) as otherwise authorized in writing by the Director.

5.5. Compost Quality Monitoring

The registration holder shall not give away or sell compost unless the compost meets:

(a) the compost quality requirements, as set out in the *Guidelines for Compost Quality*, published by CCME, as amended, for the following criteria:
  (i) maximum concentrations for trace elements;
  (ii) foreign matter;
  (iii) sharp foreign matter;
  (iv) maturity/stability;
  (v) pathogen reduction requirements; and
(b) any other requirements as specified in writing by the Director.

(c) The registration holder shall collect, at a minimum, 1 sample from each 1000 tonnes (wet weight) of compost produced per year for compost quality monitoring.

(d) The registration holder shall collect sample(s) collected under 5.6 (b) so that the samples are representative of the batch of compost.

(e) The registration holder shall dispose of all finished products that do not meet the compost quality requirements set out in 5.6 (a):
  (i) at an Alberta Environment approved waste management facility authorized to accept such waste; or,
  (ii) as otherwise authorized in writing by the Director.

6. Reporting and Record Keeping

6.1. Operating Record

(a) The registration holder shall establish and maintain an Operating Record for a composting facility until the end of the final closure period.

(b) The Operating Record shall contain, at a minimum, the following information:
  (i) a copy of the Registration document;
  (ii) a current organizational chart of the operating company;
  (iii) operation/procedures logbook;
  (iv) the most recent version of the design plan for the composting facility;
  (v) public issues and complaints;
  (vi) nuisance management;
  (vii) monitoring reports;
  (viii) inspection reports;
  (ix) maintenance records;
  (x) records of contraventions;
  (xi) tonnage reports; and
  (xii) all annual reports for the composting facility.

6.2. Monitoring Records

The registration holder shall record and retain all the following information in respect of any sampling conducted or analyses performed in accordance with these standards for a minimum of ten years, unless otherwise authorized in writing by the Director:
(a) the place, date and time of sampling;
(b) the dates the analyses were performed;
(c) the analytical techniques, methods or procedures used in the analyses;

(d) the names of the persons who collected and analyzed each sample; and
(e) the results of the analyses.

6.3. Tonnage Report

(a) Each year the registration holder shall prepare a Tonnage Report for the composting facility covering the calendar year reported on.

(b) The registration holder shall submit the Tonnage Report to the Director by March 31 of the year following the year on which the report is based.

(c) The Tonnage Report shall contain, at a minimum, the following information:
  (i) total tonnes (wet weight) of feedstock accepted;
  (ii) total tonnes (wet weight) of amendments and bulking agents used;
  (iii) total tonnes (wet weight) of compost produced; and
  (iv) total tonnes (wet weight) of compost used, sold, or given away.

6.4. Reporting of Contraventions

(a) In addition to any other reporting required pursuant to the Act or the regulations, the registration holder shall immediately report to the Director by telephone any contravention of the terms and conditions of these Standards at 1-780-422-4505.
(b) The registration holder shall submit a written report to the Director within 7 days of the reporting pursuant to 6.4 (a).
(c) The report required in 6.4 (b) shall contain, at a minimum, all of the following:
  (i) a description of the contravention;
  (ii) the date of the contravention;
  (iii) an explanation as to why the contravention occurred;
  (iv) a legal land description of the location of the contravention;
  (v) the name of the registered owner or owners of the parcel of land on which the contravention occurred;
  (vi) a summary of all measures and actions that were taken to mitigate any effects of the contravention;
  (vii) the Registration number provided by the Director for the composting facility, and the name of the person who held the Registration number at the time when the contravention occurred;
  (viii) the names, addresses, telephone numbers and job titles of all persons operating the site at the time that the contravention occurred;
  (ix) the names, addresses and telephone numbers of all persons who had charge, management or control of the site at the time that the contravention occurred;
  (x) a summary of proposed measures that will prevent future contraventions including a schedule of implementation for those measures;
  (xi) any information that was maintained or recorded under these Standards, as a result of the contravention; and
  (xii) any other information required by the Director in writing.

6.5. Annual Report

(a) During each year of operation of the composting facility, the person responsible shall prepare an Annual Report for the facility covering the calendar year reported on.

(b) The person responsible shall place the Annual Report in the Operating Record by March 31 of the year following the year on which the report is based.

(c) The Annual Report shall contain, at a minimum, the following information:
   (i) any changes in persons responsible;
   (ii) any changes made to the operations plan;
   (iii) the types and quantities of feedstocks processed at the composting facility;
   (iv) the amount of compost permanently removed from the facility or used on site;
   (v) records demonstrating pathogen reduction;
   (vi) compost quality records, including:
      a. pathogen analysis;
      b. sharp foreign matter analysis; and
      c. trace element analysis;
   (vii) the following environmental monitoring records and their interpretations:
      a. process water monitoring;
      b. table or graphical presentation of yearly groundwater monitoring records;
      c. quality and quantity of process water removed from the composting facility for irrigation or disposal; and,
      d. quality and quantity of sediments removed from the composting facility for land application or disposal.
   (viii) any remedial actions taken;
   (ix) a summary of non-compliance issues;
   (x) a summary of nuisance management issues;
   (xi) a summary of complaints received, and the action or actions taken as a result of the complaints; and
   (xii) adjustments to financial security necessary for final closure, if applicable.

6.6. Record Keeping

(a) The registration holder shall immediately provide any records, reports, documents or data required to be created under these Standards to the Director, or a representative of the Director, upon request.

(b) The registration holder shall place the Annual Report in the Operating Record by March 31 of the year following the year on which the report is based.

(c) The registration holder shall record and retain all the following information regarding each contravention of these standards or complaints from the facility for a minimum of 10 years:
   (i) the place, date and time of the contravention/complaint;
   (ii) the name, and address of the contravention/complainant;
   (iii) the nature of the contravention/complaint; and
   (iv) a description of the contingency plan implemented.

7. Final Closure

7.1. Final Closure Plan

(a) The registration holder shall notify the Director of the closure of the composting facility by submitting a Final Closure Plan within 6 calendar months after the final acceptance of feedstock at the composting facility.

(b) The Final Closure Plan shall include, at a minimum, the following:
- (i) schedule for completion;
- (ii) description of the final use of the closed areas;
- (iii) description of site restoration procedures, including:
  - a. drainage;
  - b. soil replacement;
  - c. erosion control;
  - d. revegetation, where applicable;
- (iv) compost removal;
- (v) waste disposal;
- (vi) maintenance and operations of contaminant monitoring systems until performance measures are met for soil and groundwater, if applicable.

(c) The Final Closure Plan shall be implemented in accordance with written authorization of Director.

7.2. Final Closure Report

(a) The registration holder shall file a copy of the Final Closure Report in the Operating Record for the calendar year in which Final Closure will be complete.

(b) The Final Closure Report shall include, at a minimum, the following:
- (i) the date of completion of the final closure;
- (ii) a statement including supporting evidence that the final closure has been completed in accordance with the final closure plan;
- (iii) a description of any deviations to the final closure plan and the reasons for the deviations; and
- (iv) a description of how the following elements (if applicable) have been, or will be dealt with
  - a. the final use of the closed areas;
  - b. drainage restoration;
  - c. soil replacement;
  - d. erosion control; and
  - e. re-vegetation.
- (v) a groundwater report with supporting evidence to show that groundwater has not been contaminated.

CLASS III COMPOSTING FACILITIES

1. Notification

1.1. Notification Form

(a) The person responsible for a Class III composting facility shall submit the following to the Director prior to commencing construction and operation of the composting facility.
- (i) a Notification form;
- (ii) a Composting Facility Checklist; and
- (iii) an Operations Plan.

1.2. Operations Plan

(a) The Operations Plan shall include, at a minimum, the following:
- (i) feedstock acceptance policies and procedures;
- (ii) site security and public access control procedures;
- (iii) working surface maintenance program;
- (iv) a composting process plan, including:
  - a. procedures for maintaining aerobic conditions;
  - b. corrective measures for excessive odours;
  - c. a pathogens reduction plan;
  - d. a composting temperature monitoring program;
  - e. quality assurance and quality control program, based on regulatory requirements;
  - f. procedures for curing compost to meet maturity requirements;
  - g. procedures for storage and management of final product;
  - h. procedures for preventing pathogen re-growth in final product;

(b) process water management procedures;
(c) procedures for handling and disposal of residual materials (compostable and non-compostable); and
(d) nuisance management plan.

2. Facility Design Requirements

2.1. Facility Design

The receiving, feedstock preparation, active composting, curing and storage areas must:
- (a) have a working surface that is capable of withstanding the wear and tear from normal operations;
- (b) be located on a liner or natural protective layer to prevent the release of process water into the environment;
- (c) have a separation of at least one meter above the seasonally high water table; and
- (d) be graded for positive drainage to prevent ponding of water.

2.2. Run-off, Run-on Control

The entire composting facility must have run-on and run-off controls that:
- (a) prevents the flow of surface waters on to the composting facility; and
- (b) prevents process water from contaminating groundwater and surface water.

3. Facility Construction

The person responsible shall construct the composting facility in accordance with the design specified in 2.1 and 2.2.

4. Environmental setbacks

Unless authorized in writing by the Director, no person shall construct or operate a composting facility:
- (a) within 100 metres from a spring;
- (b) within 100 metres from a water well; or
- (c) within 30 metres from a water body.

5. Composting Facility Capacity

The amount of leaf and yard waste accepted each year to a Class III composting facility must not at any time exceed 500 tonnes per annum, wet weight.

6. Facilities Operations

6.1. Person Responsible

The person responsible must notify the Director within 30 calendar days of a change of ownership.

6.2. Signage

The person responsible shall
(a) post; and
(b) maintain
signs at the composting facility entrance providing, at a minimum, the following information:
  (i) name of registration holder or person responsible;
  (ii) telephone numbers for:
    a. 24hr emergency contact;
    b. the local fire department; and
    c. Alberta Environment (1-800-222-6514); and,
  (iii) hours of operation.

6.3. Operations Plan

The person responsible shall:
(a) implement; and
(b) update
the Operations Plan in compliance with the composting facility design plan and specifications.

6.4. Nuisance Management

The shall control nuisances such as, but not limited to, litter, fires, disease vectors, and dust, by:
(a) establishing and maintaining litter controls that include:
  (i) minimize the escape of litter from the composting facility;
  (ii) implementing controls to prevent litter to be washed, blown, or transported onto adjacent properties; and
  (iii) retrieving litter that has been washed, blown, or transported onto adjacent properties, provided the consent of the owner of the adjacent property is first obtained.
(b) managing the feedstock storage and the composting process to minimize disease vectors;
(c) applying weed controls to prevent accumulation of weeds at the facility and in compost products;
(d) managing feedstock storage and composting process to prevent the occurrence of fires; and
(e) set up or construct artificial barriers, utilizing natural barriers, or other effective measures to control access to the site to prevent the uncontrolled depositing of wastes or other materials.

7. Environmental Monitoring Standards

7.1. Sampling and Analytical Standards

(a) With respect to any sample required to be taken these guidelines, all samples shall be:

- (i) collected;
- (ii) preserved;
- (iii) stored,
- (iv) handled; and
- (v) analyzed

in accordance with:

- (vi) the *Standard Methods for the Examination of Water and Wastewater*, published jointly by the American Public Health Association, American Water Works Association, and the Water Environment Federation, 1998, as amended or
- (vii) the *Methods Manual for Chemical Analysis of Water and Wastes*, Alberta Environmental Centre, Vegreville, Alberta, 1996, AECV96-M1 as amended; or
- (viii) the *Guidelines for Compost Quality*, published by the CCME, as amended; or
- (ix) The *Test Methods for the Examination of Composting and Composts*, published by the United States Department of Agriculture and the United States Composting Council, as amended; or
- (x) a method authorized in writing by the Director.

(b) The person responsible shall analyze all samples that are required to be obtained by these standards in a laboratory accredited pursuant to ISO 17025 standard, as amended, for the specific parameter(s) to be analyzed, unless otherwise authorized in writing by the Director.

(c) The term sample as used in 7.1(b) does not include samples directed to continuous monitoring equipment, until specifically required in writing by the Director.

7.2. Compost Quality Monitoring

(a) The person responsible shall not give away or sell compost unless the compost meets the compost quality requirements, as set out in the Guidelines for Compost Quality, published by CCME, as amended, for the following criteria:

- (i) maximum concentrations for trace elements;
- (ii) foreign matter;
- (iii) sharp foreign matter;
- (iv) maturity/stability; and
- (v) pathogen reduction requirements;

(b) The person responsible shall collect a minimum of one composite sample for compost quality monitoring per calendar year if the compost is transferred to third parties.

(c) The person responsible shall collect sample(s) collected under 7.2 (b) so that the samples are representative of the batch of compost.

(d) The person responsible shall dispose of all finished products that do not meet the compost quality requirements set out in 5.6 (a):

- (i) at an Alberta Environment approved waste management facility authorized to accept such waste; or,
- (ii) as otherwise authorized in writing by the Director.

8. Reporting and Record Keeping

Annual Report

(a) During each year while the composting facility is operational, the person responsible shall prepare an Annual Report for the composting facility covering the calendar year reported on.

(b) The person responsible shall provide the Annual Report to the Director upon a request in writing.

(c) The Annual Report shall contain, at a minimum, the following information:
  (i) any changes of ownership or persons responsible;
  (ii) any changes made to the operations plan;
  (iii) water quality testing, if done
  (iv) compost quantity records;
  (v) the amount of compost permanently removed from the facility;
  (vi) the amount of compost stored at the facility;
  (vii) records demonstrating pathogen reduction; and
  (viii) compost quality records.

9. Final Closure Notification

The person responsible shall notify the Director of the closure of the composting facility by submitting a Final Closure Notification within 6 calendar months after the final acceptance of feedstock at the composting facility.

Appendix A

Registration Application for Class II Composting Facilities

1. General Information

Applicant Name

Mailing Address

Legal Land Description for composting facility

Contact Person

Phone Number Fax Number

2. Technical Information

Please provide the following information as specified in the Standards for Composting Facilities in Alberta

(a) a composting facility checklist;
(b) a facility design plan and specifications;
(c) a topsoil stockpile plan;
(d) an operations plan;
(e) an odour management program;
(f) a groundwater monitoring program; and
(g) a background groundwater quality report

3. Deviations from Standards

Are you requesting deviations from the Composting Facility Standards for environmental setbacks, design and construction, feedstock accepted, or environmental monitoring? Yes ☐ No☐

Note: Director authorization is required prior to deviating from the Composting Facility Standards.

If yes, please fill in section below:

Request deviations from:	Yes	No
Environmental setbacks (Section 2)	☐	☐
Standard construction specifications		
Facility liner (Sections 3.2)	☐	☐
Retention pond liner (Section 3.3)	☐	☐
Ground water monitoring (Section 3.4)	☐	☐
Feedstock list (Section 4.4)	☐	☐
Standard environmental monitoring procedures		
Sampling and analytical methods (Section 5.1)	☐	☐
Groundwater monitoring (Section 5.2)	☐	☐

Please contact your regional Alberta Environment office to determine what additional information needs to be added to your application.

4. Other Information

Please provide

Where appropriate, a copy of the field approval issued under section of the Public Lands Act

The rationale for the compost facility, in writing.

I acknowledge that I have reviewed a copy of the Standards for Composting Facilities in Alberta, and that I am bound by the provisions of the Standard and any subsequent amendments to it.

Applicant Signature: ______________________________ Date:

Date received:

Registered by:

Director's Signature______________________________ Date

Appendix B

Notification Form for Class III Composting Facilities

1. General Information

Applicant Name

Mailing Address

Legal Land Description for composting facility

Contact Person

Phone Number Fax Number

2. Technical Information

Please provide the following information as specified in the Standards for Composting Facilities in Alberta

(a) a composting facility checklist;
(b)
(c) an operations plan;
(d)

3. Deviations from Standards

Are you requesting any deviations from the Composting Facility Standards for construction, feedstock accepted, or environmental monitoring? Yes ☐ No☐

Note: Director authorization is required prior to deviating from the Composting Facility Standards.

If yes, please fill in section below:

Request deviations from:	Yes	No
Standard construction specifications		
Facility liner (Sections 3.2)	☐	☐
Retention pond liner (Section 3.3)	☐	☐
Ground water monitoring (Section 3.4)	☐	☐
Feedstock list (Section 4.4)	☐	☐
Standard environmental monitoring procedures		
Sampling and analytical methods (Section 5.1)	☐	☐
Groundwater monitoring (Section 5.2)	☐	☐

Please contact your regional Alberta Environment office to determine what additional information needs to be added to your application.

Appendix C

COMPOSTING FACILITY CHECKLIST

(TO BE SUBMITTED WITH REGISTRATION/ NOTIFICATION FORM)

Purpose of checklist:

The purpose of this checklist is to ensure the person responsible for the siting and construction of a newly proposed or laterally expanding compost facility has taken the necessary measures to suitably locate the facility according to the most recent version of the AENV Standards and Guidelines for composting facilities. This includes consultation with municipal planning staff regarding planning and development approvals.

NOTE: This checklist is not intended for composting facilities that are proposed at landfills or wastewater treatment plants where land use is already designated.

Name of proposed facility: ______________________________

Name of applicant: ______________________________

Address: ____________________ **Email:** ____________________**(optional)**

____

____

Phone number: ____________________ **Fax:** ____________________

Project Location: ______________________________

Legal Land Description: ______________________________

Facility Street Address: ____________________ **Parcel Size:** ____________________

____

____

Tentative construction start date: ____________________ **Tentative Facility Start up Date:** ____________________

1) List any provincial registrations, approvals or municipal permits that will be needed for your proposal, e.g. Composting facility registration, development permit, road side development permit, etc. and provide the names of local officials you are working with. If you need more space please attach a separate sheet.

Permit: ______________________ Officer/Planner's Name: ______________________

Permit: ______________________ Officer/Planner's Name: ______________________

Permit : ______________________ Officer/Planner's Name: ______________________

Permit: ______________________ Officer/Planner's Name: ______________________

2) Attach a site plan, vicinity map, and/or topographic map of the proposed location, if reasonably available.

3) How much land (hectares) will be leased/purchased for your proposal?

4) How much of that land will be used by the composting facility (facility footprint)? If possible please provide the size of the area designated for receiving, processing, curing, the retention pond, and buffer zones.

5) Give a brief description of the type and quantity of organic materials that will be composted at this facility. Please included all primary feedstocks and amendments.

6) Does this facility require financial security in accordance with Part 4, section 27 - 33 of the Waste Control Regulations? YES NO

7) Do you plan on doing a public consultation process? If so, please describe. YES NO

8) What general types of soils are found on the site (for example, clay, sand, gravel, peat)?

9) What is the current use of the site?

10) What is the current land use designation of the site?

11) Is the facility within 450 metres from schools, residential housing, and Food Establishments? YES NO

12) Is there a hospital within 450 metres from the site? YES NO

13) Identify existing roads or highways serving the site. Show on site plans, if any.
Permits are required if the facility is within 300 metres of a highway and 800 metres of an intersection of a controlled highway.

14) What designated and informal recreational opportunities are in the immediate vicinity?

15) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, rivers, lakes, ponds, wetlands)? If yes, describe type and provide names (if applicable). YES NO

16) Will the project require any work within 30 metres of the described bodies of water? YES NO
If yes, please describe

17) Is there a drinking water well within 450 metres from the site? YES NO

18) Is there a spring within 100 metres from the site? YES NO

19) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan. YES NO
Flood risk maps are available from Alberta Environment
`http://www3.gov.ab.ca/env/water/flood/index.html`)

20) Will any wastewater be discharged to surrounding land? If so, please provide a general description and indicate the area on the site plan. YES NO

21) How deep is the seasonal high water table from the surface?

22) Have you included the information required in Section 1of the standards? YES NO

The above answers are true and complete to the best of my knowledge.

Signature: ....

Date Submitted: ....

APPENDIX B

COMPOSTING FACILITY COST ESTIMATES

Alberta Environment L&YW Diversion Strategy
Typical Small Scale (<1,000 tpy) Composting Facility Development Cost Estimate

Description	Qty	Unit	Total Unit Cost	Total Cost	Subtotals
Compost Pad (60 m x 45 m)					**$55,755**
Onsite haul of excavated material 0.25km round trip , 15 loads/hr	-	CM	$3.00	$0	
Mass Rock Removal	-	CM	$25.00	$0	
Sub-grade Finishing and compaction	2,700	SM	$2.00	$5,400	
Clay Liner (10-7 cm/s, 0.5m thick)	1,350	CM	$20.00	$27,000	
Geotextile Barrier (supply and install)	2,700	SM	$7.00	$18,900	
Granular base (25mm minus, 100mm thick)	270	CM	$4.00	$1,080	
Ditching around pad	225	LM	$15.00	$3,375	
Access Roadways (10m x 10m)					**$2,390**
Mass Rock Removal	-	CM	$25.00	$0	
Common Excavation (0,5 m depth)	50	CM	$6.00	$300	
Onsite haul of excavated material 0.25km round trip , 15 loads/hr	-	CM	$3.00	$0	
Culvert (16" dia)	1	LS	$1,000.00	$1,000	
Sub-grade Finishing and compaction	100	SM	$2.00	$200	
Granular sub-base (350mm thick)	35	CM	$24.00	$840	
Granular base (100mm thick)	10	SM	$5.00	$50	
Ditching along roadway	-	LM	$15.00	$0	
Surface Water Detention Pond					**$4,000**
Pond Excavation (stockpile spoil onsite)	200	CM	$5.00	$1,000	
40-mil HDPE Pond Liner	150	SM	$20.00	$3,000	
Subtotal					**$62,145**
Misc Detail Allowance	**5.0%**				**$3,107**
Subtotal					**$65,252**
Contingency	**30.0%**				**$19,576**
Subtotal					**$84,828**
Mobilization & Bonds	**10.0%**				**$8,483**
Construction Total					**$93,311**
Design & Construction Supervision	**8.0%**				**$7,465**
Construction Total (Rounded)					**$110,000**
Engineering					**5,000**
Geotechnical					**5,000**
Total Development					**120,000**

Notes:

1. The budget is based on 2009 rates from Calgary. The estimate is prepared with due diligence with the available information and under normal operations. However this should be subject to market demands and circumstances especially in view of the escalation costs in the lower mainland with ongoing numerous mega projects. The possibility of securing a competive bid process is questionable and should be taken into consideration. Factors tha may affect the estimate on the following issues but NOT factored into the estimate include escalation, premium on labour, engineering, construction management, financing and bonding, O&M and undetermined hazardous material mitigation cost.
2. The final cost do the project will be subject to labour rates (currently under negotitation), material cost, actual site conditions, availability of labour, material and equipment, final project scope, final project schedule (flexible or fixed), public consultation and input, and other mitigating factors (e.g. timing of construction and award). As a result, the final project cost may defer from the presented budget.
3. Due to facts mentioned, the funding of the project should be carefully reviewed prior to establishing the final budget.

Exclusions:

PST & GST not included
Municipal tees & Licences not included
Engineering Fees & Disbursement not included

Typical Small Scale Composting Facility Equipment Cost Estimate

Description	Qty	Unit	Total Unit Cost	Total Cost	Subtotals
Equipment					**$2,000**
Monitoring Equipment	1	LS	$750	$750	
Firefighting and Water Addition Equipment	1	LS	$1,250	$1,250	

Alberta Environment L&YW Diversion Strategy
Typical Medium Scale (4,000 tpy) Composting Facility Development Cost Estimate

Description	Qty	Unit	Total Unit Cost	Total Cost	Subtotals
Compost Pad (110 m x 235 m)					**$511,990**
Onsite haul of excavated material 0.25km round trip , 15 loads/hr	-	CM	$3.00	$0	
Mass Rock Removal	-	CM	$25.00	$0	
Sub-grade Finishing and compaction	25,850	SM	$2.00	$51,700	
Clay Liner (10-7 cm/s, 0.5m thick)	12,925	CM	$20.00	$258,500	
Geotextile Barrier (supply and install)	25,850	SM	$7.00	$180,950	
Granular base (25mm minus, 100mm thick)	2,585	CM	$4.00	$10,340	
Ditching around pad	700	LM	$15.00	$10,500	
Access Roadways (10m x 10m x 2)					**$4,780**
Mass Rock Removal	-	CM	$25.00	$0	
Common Excavation (0,5 m depth)	100	CM	$6.00	$600	
Onsite haul of excavated material 0.25km round trip , 15 loads/hr	-	CM	$3.00	$0	
Culvert (16" dia)	2	LS	$1,000.00	$2,000	
Sub-grade Finishing and compaction	200	SM	$2.00	$400	
Granular sub-base (350mm thick)	70	CM	$24.00	$1,680	
Granular base (100mm thick)	20	SM	$5.00	$100	
Ditching along roadway	-	LM	$15.00	$0	
Surface Water Detention Pond					**$23,525**
Pond Excavation (stockpile spoil onsite)	1,765	CM	$5.00	$8,825	
40-mil HDPE Pond Liner	735	SM	$20.00	$14,700	
Subtotal					**$540,295**
Misc Detail Allowance	**5.0%**				**$27,015**
Subtotal					**$567,310**
Contingency	**30.0%**				**$170,193**
Subtotal					**$737,503**
Mobilization & Bonds	**10.0%**				**$73,750**
Construction Total					**$811,253**
Design & Construction Supervision	**8.0%**				**$64,900**
Construction Total (Rounded)					**$880,000**
Engineering					**10,000**
Geotechnical					**10,000**
Total Development					**900,000**

Notes:

1. The budget is based on 2009 rates from Calgary. The estimate is prepared with due diligence with the available information and under normal operations. However this should be subject to market demands and circumstances especially in view of the escalation costs in the lower mainland with ongoing numerous mega projects. The possibility of securing a competive bid process is questionable and should be taken into consideration. Factors tha may affect the estimate on the following issues but NOT factored into the estimate include escalation, premium on labour, engineering, construction management, financing and bonding, O&M and undetermined hazardous material mitigation cost.
2. The final cost do the project will be subject to labour rates (currently under negotitation), material cost, actual site conditions, availability of labour, material and equipment, final project scope, final project schedule (flexible or fixed), public consultation and input, and other mitigating factors (e.g. timing of construction and award). As a result, the final project cost may defer from the presented budget.
3. Due to facts mentioned, the funding of the project should be carefully reviewed prior to establishing the final budget.

Exclusions:

PST & GST not included
Municipal fees & Licences not included
Engineering Fees & Disbursement not included

Typical Medium Scale Composting Facility Equipment Cost Estimate

Description	Qty	Unit	Total Unit Cost	Total Cost	Subtotals
Equipment					**$99,250**
Windrow Turner	1	LS	$85,000	$85,000	
Hard-hose reel and pump	1	LS	$12,000	$12,000	
Monitoring Equipment	1	LS	$1,000	$1,000	
Firefighting and Water Addition Equipment	1	LS	$1,250	$1,250	

Alberta Environment L&YW Diversion Strategy
Typical Large Scale (15,000 tpy) Composting Facility Development Cost Estimate

Description	Qty	Unit	Total Unit Cost	Total Cost	Subtotals
Compost Pad (140 m x 225 m)					**$622,050**
Onsite haul of excavated material 0.25km round trip , 15 loads/hr	-	CM	$3.00	$0	
Mass Rock Removal	-	CM	$25.00	$0	
Sub-grade Finishing and compaction	31,500	SM	$2.00	$63,000	
Clay Liner (10-7 cm/s, 0.5m thick)	15,750	CM	$20.00	$315,000	
Geotextile Barrier (supply and install)	31,500	SM	$7.00	$220,500	
Granular base (25mm minus, 100mm thick)	3,150	CM	$4.00	$12,600	
Ditching around pad	730	LM	$15.00	$10,950	
Access Roadways (10m x 10m x 2)					**$4,780**
Mass Rock Removal	-	CM	$25.00	$0	
Common Excavation (0.5 m depth)	100	CM	$6.00	$600	
Onsite haul of excavated material 0.25km round trip , 15 loads/hr	-	CM	$3.00	$0	
Culvert (16" dia)	2	LS	$1,000.00	$2,000	
Sub-grade Finishing and compaction	200	SM	$2.00	$400	
Granular sub-base (350mm thick)	70	CM	$24.00	$1,680	
Granular base (100mm thick)	20	SM	$5.00	$100	
Ditching along roadway	-	LM	$15.00	$0	
Surface Water Detention Pond					**$28,000**
Pond Excavation (stockpile spoil onsite)	2,100	CM	$5.00	$10,500	
40-mil HDPE Pond Liner	875	SM	$20.00	$17,500	
Subtotal					**$654,830**
Misc Detail Allowance	**5.0%**				**$32,742**
Subtotal					**$687,572**
Contingency	**30.0%**				**$206,271**
Subtotal					**$893,843**
Mobilization & Bonds	**10.0%**				**$89,384**
Construction Total					**$983,227**
Design & Construction Supervision	**8.0%**				**$78,658**
Construction Total (Rounded)					**$1,070,000**
Engineering					**10,000**
Geotechnical					**10,000**
Total Development					**1,090,000**

Notes:

1. The budget is based on 2009 rates from Calgary. The estimate is prepared with due diligence with the available information and under normal operations. However this should be subject to market demands and circumstances especially in view of the escalation costs in the lower mainland with ongoing numerous mega projects. The possibility of securing a competive bid process is questionable and should be taken into consideration. Factors tha may affect the estimate on the following issues but NOT factored into the estimate include escalation, premium on labour, engineering, construction management, financing and bonding, O&M and undetermined hazardous material mitigation cost.
2. The final cost do the project will be subject to labour rates (currently under negotitation), material cost, actual site conditions, availability of labour, material and equipment, final project scope, final project schedule (flexible or fixed), public consultation and input, and other mitigating factors (e.g. timing of construction and award). As a result, the final project cost may defer from the presented budget.
3. Due to facts mentioned, the funding of the project should be carefully reviewed prior to establishing the final budget.

Exclusions:

PST & GST not included
Municipal tees & Licences not included
Engineering Fees & Disbursement not included

Typical Large Scale Composting Facility Equipment Cost Estimate

Description	Qty	Unit	Total Unit Cost	Total Cost	Subtotals
Equipment					**$590,000**
Front-end Loader	1	LS	$225,000	$225,000	
Windrow Turner	1	LS	$350,000	$350,000	
Hard-hose reel and pump	1	LS	$12,000	$12,000	
Monitoring Equipment	1	LS	$1,750	$1,750	
Firefighting and Water Addition Equipment	1	LS	$1,250	$1,250	

APPENDIX C

REGIONAL INFRASTRUCTURE DEVELOPMENT REQUIREMENTS

Municipality	L&YW Quantity Diverted	Geographic Region	New or Improve Collection Depots	New Class 2 Facilities	New Class 3 Facilities	Improve Existing Facility
Cold Lake	500	Lower Athabasca				$125,000
Lac La Biche County	200	Lower Athabasca			$75,000	
Wood Buffalo, Regional Municipality Of	3,000	Lower Athabasca				$750,000
Bonnyville	200	Lower Athabasca			$75,000	
	3,900	**Lower Athabasca Total**	**$0**	**$0**	**$150,000**	**$875,000**
High Level	130	Lower Peace				$75,000
Manning	35	Lower Peace			$25,000	
Peace River	215	Lower Peace			$75,000	
Rainbow Lake	25	Lower Peace			$25,000	
	405	**Lower Peace Total**	**$0**	**$0**	**$125,000**	**$75,000**
Banff	230	North Saskatchewan				$75,000
Camrose	600	North Saskatchewan				$175,000
Daysland	22	North Saskatchewan	$7,500			
Bashaw	25	North Saskatchewan	$7,500			
Drayton Valley	235	North Saskatchewan				$75,000
Edmonton	100,000	North Saskatchewan				$0
Strathcona County	3,150	North Saskatchewan	$7,500			
Spruce Grove	740	North Saskatchewan	$7,500			
St. Albert	2,225	North Saskatchewan	$7,500			
Stony Plain	450	North Saskatchewan	$7,500			
Flagstaff Regional LF						$50,000
Hardisty	20	North Saskatchewan	$7,500			
Killam	25	North Saskatchewan	$7,500			
Sedgewick	25	North Saskatchewan	$7,500			
Fort Saskatchewan	625	North Saskatchewan				$175,000
Bruderheim	26	North Saskatchewan	$7,500			
Lamont	36	North Saskatchewan	$7,500			
Lloydminster	600	North Saskatchewan		$175,000		
Vermilion	150	North Saskatchewan	$7,500			
Leduc	750	North Saskatchewan				$360,000
Calmar	45	North Saskatchewan	$7,500			
Beaumont	425	North Saskatchewan	$7,500			
Devon	215	North Saskatchewan	$7,500			
Provost	45	North Saskatchewan				$25,000
Rocky Mountain House	245	North Saskatchewan				$75,000
St. Paul	185	North Saskatchewan			$75,000	
Elk Point	35	North Saskatchewan	$7,500			
Two Hills	27	North Saskatchewan	$7,500			
Roseridge		North Saskatchewan				$125,000
Morinville	245	North Saskatchewan	$7,500			
Redwater	50	North Saskatchewan	$7,500			
Legal	26	North Saskatchewan	$7,500			
Bon Accord	35	North Saskatchewan	$7,500			
Gibbons	100	North Saskatchewan	$7,500			
Ryley	15	North Saskatchewan			$50,000	
Tofield	40	North Saskatchewan	$7,500			
Viking	25	North Saskatchewan	$7,500			
Smoky Lake	22	North Saskatchewan			$25,000	
Vegreville	190	North Saskatchewan			$75,000	
Mundare	20	North Saskatchewan	$7,500			
Wainwright	195	North Saskatchewan			$75,000	
Wetaskiwin	425	North Saskatchewan				$125,000
Millet	46	North Saskatchewan	$7,500			
	112,590	**North Saskatchewan Total**	**$195,000**	**$175,000**	**$300,000**	**$1,260,000**
Blackfalds	165	Red Deer				$75,000
Coronation	25	Red Deer			$25,000	
Drumheller	260	Red Deer				$75,000
Eckville	25	Red Deer				$25,000
Hanna	95	Red Deer			$50,000	
Innisfail	260	Red Deer				$75,000
Bowden	25	Red Deer	$7,500			
Lacombe	435	Red Deer				$125,000
Bentley	25	Red Deer	$7,500			
Olds	250	Red Deer				$125,000
Carstairs	90	Red Deer	$7,500			
Didsbury	155	Red Deer	$7,500			
Sundre	85	Red Deer	$7,500			
Three Hills	115	Red Deer	$7,500			
Trochu	25	Red Deer	$7,500			
Oyen	25	Red Deer			$25,000	
Ponoka	225	Red Deer				$75,000
Red Deer	3,000	Red Deer				$875,000
Penhold	46	Red Deer	$7,500			
Sylvan Lake	425	Red Deer	$7,500			
Rimbey	55	Red Deer				$50,000
Stettler	200	Red Deer				$75,000
Castor	25	Red Deer	$7,500			
	6,036	**Red Deer Total**	**$75,000**	**$0**	**$100,000**	**$1,575,000**

Municipality	L&YW Quantity Diverted	Geographic Region	New or Improve Collection Depots	New Class 2 Facilities	New Class 3 Facilities	Improve Existing Facility
Airdrie	1,300	South Saskatchewan				$600,000
Cochrane	565	South Saskatchewan	$7,500			
Crossfield	90	South Saskatchewan	$7,500			
Irricana	25	South Saskatchewan	$7,500			
Canmore	450	South Saskatchewan				
Brooks	515	South Saskatchewan				$125,000
Bassano	30	South Saskatchewan	$7,500			
Calgary	145,000	South Saskatchewan				$15,000,000
Chestermere	500	South Saskatchewan	$7,500			
Strathmore	425	South Saskatchewan	$7,500			
Townsite Of Redwood Meadows Admin Soc	25	South Saskatchewan	$7,500			
Cardston	120	South Saskatchewan			$75,000	
Claresholm	125	South Saskatchewan			$75,000	
Fort Macleod	105	South Saskatchewan	$7,500			
Foothills Regional Landfill		South Saskatchewan				$0
Black Diamond	45	South Saskatchewan	$7,500			
High River	400	South Saskatchewan	$0			
Nanton	45	South Saskatchewan	$7,500			
Okotoks	765	South Saskatchewan	$7,500			
Turner Valley	45	South Saskatchewan	$7,500			
Vulcan	45	South Saskatchewan	$7,500			
Lethbridge	3,200	South Saskatchewan				$1,000,000
Magrath	50	South Saskatchewan	$7,500			
Coaldale	215	South Saskatchewan	$7,500			
Coalhurst	35	South Saskatchewan	$7,500			
Picture Butte	35	South Saskatchewan	$7,500			
Raymond	120	South Saskatchewan	$7,500			
Stirling	25	South Saskatchewan	$7,500			
Medicine Hat	2,250	South Saskatchewan				$600,000
Redcliff	175	South Saskatchewan	$7,500			
Milk River	23	South Saskatchewan			$25,000	
Pincher Creek	125	South Saskatchewan	$7,500		$75,000	
Crowsnest Pass, Municipality Of	200	South Saskatchewan	$7,500			
Taber	260	South Saskatchewan				$75,000
Bow Island	40	South Saskatchewan	$7,500			
Vauxhall	25	South Saskatchewan	$7,500			
	157,398	**South Saskatchewan Total**	**$180,000**	**$0**	**$250,000**	**$17,400,000**
Jasper, Municipality Of	135	Upper Athabasca				$75,000
Athabasca	100	Upper Athabasca			$75,000	
Barrhead	145	Upper Athabasca			$75,000	
Edson	280	Upper Athabasca				$75,000
High Prairie	95	Upper Athabasca			$75,000	
Hinton	325	Upper Athabasca			$125,000	
Slave Lake	235	Upper Athabasca				$75,000
Swan Hills	40	Upper Athabasca			$25,000	
Westlock	165	Upper Athabasca			$75,000	
Whitecourt	310	Upper Athabasca			$125,000	
Mayerthorpe	35	Upper Athabasca	$7,500			
Alberta Beach	25	Upper Athabasca				$25,000
	1,890	**Upper Athabasca Total**	**$7,500**	**$0**	**$575,000**	**$250,000**
Grande Prairie	1,900	Upper Peace				$500,000
Sexsmith	50	Upper Peace	$7,500			
Wembley	30	Upper Peace	$7,500			
Beaverlodge	50	Upper Peace			$50,000	
Fairview	110	Upper Peace			$75,000	
Grimshaw	85	Upper Peace	$7,500			
Hines Creek	15	Upper Peace	$7,500			
Falher	25	Upper Peace			$50,000	
Mclennan	25	Upper Peace	$7,500			
Fox Creek	50	Upper Peace			$50,000	
Grande Cache	125	Upper Peace			$75,000	
Spirit River	25	Upper Peace			$25,000	
Valleyview	40	Upper Peace			$25,000	
	2,530	**Upper Peace Total**	**$37,500**	**$0**	**$350,000**	**$500,000**
		Grand Total	**$495,000**	**$175,000**	**$1,850,000**	**$21,935,000**

Capacity Rate (tonnes)	Facility Cost
<50	$25,000
50 - 100	$50,000
100 - 300	$75,000
300 - 500	$125,000
<500	@ $250/tonne of capacity

APPENDIX D

PROVINCIAL LEVY FUND PROFORMA

Alberta L&YW Diversion Levy Proforma
Scenario: Capital Development Costs

PROGRAM YEAR	0	1	2	3	4	5
MSW Tonnage	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000
L&YW Diversion	71,250	99,750	142,500	171,000	213,750	285,000
Other Diversion (%)	0%	5%	10%	10%	15%	15%
Other Diversion (tonne)	0	175000	350000	350000	525000	525000
Levy Tonnage	3,428,750	3,225,250	3,007,500	2,979,000	2,761,250	2,690,000
Levy Amount Per Tonne	$ -	$ 2.00	$ 2.00	$ 2.00	$ 2.00	$ 2.00
Annual Levy Contr	$ -	$ 6,450,500	$ 6,015,000	$ 5,958,000	$ 5,522,500	$ 5,380,000
Diversion Target	285000	285000	285000	285000	285000	285000
Performance	25%	35%	50%	60%	75%	100%
Diverted Tonnage	71250	99750	142500	171000	213750	285000
Capital Development						
% of total	0%	25%	30%	30%	10%	5%
Capital Development	$ -	$ 6,111,250	$ 7,333,500	$ 7,333,500	$ 2,444,500	$ 1,222,250
Operations						
per tonne	0	0	0	0	0	0
total	$ -	$ -	$ -	$ -	$ -	$ -
Fund Management	$ 750,000	$ 750,000	$ 750,000	$ 750,000	$ 750,000	$ 750,000
Total Spending	$ 750,000	$ 6,861,250	$ 8,083,500	$ 8,083,500	$ 3,194,500	$ 1,972,250
Levy Fund						
Input	$0	$6,450,500	$6,015,000	$5,958,000	$5,522,500	$5,380,000
Payments	$750,000	$6,861,250	$8,083,500	$8,083,500	$3,194,500	$1,972,250
End of YearFund Value	-$750,000	$1,160,750	-$3,229,250	-$5,354,750	-$3,026,750	$381,000

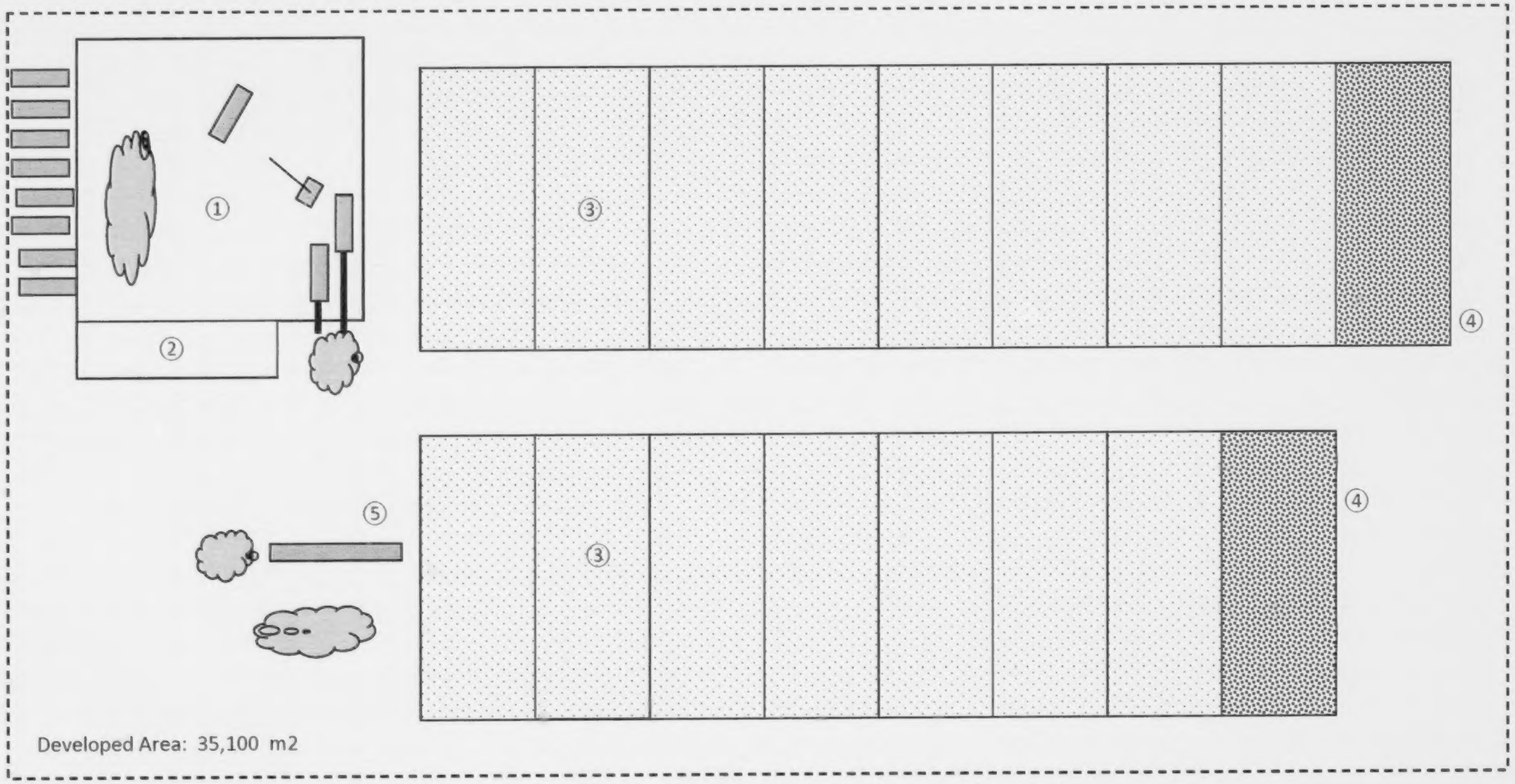
Alberta L&YW Diversion Levy Proforma
Scenario: Capital Development and Operational Costs

PROGRAM YEAR	0	1	2	3	4	5	6	7	8	9	10
MSW Tonnage	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000
L&YW Diversion	71,250	99,750	142,500	171,000	213,750	285,000	285,000	285,000	285,000	285,000	285,000
Other Diversion (%)	0%	5%	10%	10%	15%	15%	20%	20%	25%	25%	30%
Other Diversion (tonne)	0	175000	350000	350000	525000	525000	700000	700000	875000	875000	1050000
Levy Tonnage	3,428,750	3,225,250	3,007,500	2,979,000	2,761,250	2,690,000	2,515,000	2,515,000	2,340,000	2,340,000	2,165,000
Levy Amount Per Tonne	$ -	$ 4.50	$ 4.50	$ 4.50	$ 4.50	$ 4.50	$ 4.50	$ 4.50	$ 4.50	$ 4.50	$ 4.50
Annual Levy Contr	$ -	$ 14,513,625	$ 13,533,750	$ 13,405,500	$ 12,425,625	$ 12,105,000	$ 11,317,500	$ 11,317,500	$ 10,530,000	$ 10,530,000	$ 9,742,500
Diversion Target	285000	285000	285000	285000	285000	285000	285000	285000	285000	285000	285000
Performance	25%	35%	50%	60%	75%	100%	100%	100%	100%	100%	100%
Diverted Tonnage	71250	99750	142500	171000	213750	285000	285000	285000	285000	285000	285000
Capital Development											
% of total	0%	25%	30%	30%	10%	5%	0%	0%	0%	0%	0%
Capital Development	$ -	$ 6,111,250	$ 7,333,500	$ 7,333,500	$ 2,444,500	$ 1,222,250	$ -	$ -	$ -	$ -	$ -
Operations											
per tonne	0	35	35	35	35	35	35	35	35	35	35
total	$ -	$ 3,491,250	$ 4,987,500	$ 5,985,000	$ 7,481,250	$ 9,975,000	$ 9,975,000	$ 9,975,000	$ 9,975,000	$ 9,975,000	$ 9,975,000
Fund Management	$ 750,000	$ 750,000	$ 750,000	$ 750,000	$ 750,000	$ 750,000	$ 750,000	$ 750,000	$ 750,000	$ 750,000	$ 750,000
Total Spending	$ 750,000	$ 10,352,500	$ 13,071,000	$ 14,068,500	$ 10,675,750	$ 11,947,250	$ 10,725,000	$ 10,725,000	$ 10,725,000	$ 10,725,000	$ 10,725,000
Levy Fund											
Input	$0	$14,513,625	$13,533,750	$13,405,500	$12,425,625	$12,105,000	$11,317,500	$11,317,500	$10,530,000	$10,530,000	$9,742,500
Payments	$750,000	$10,352,500	$13,071,000	$14,068,500	$10,675,750	$11,947,250	$10,725,000	$10,725,000	$10,725,000	$10,725,000	$10,725,000
End of YearFund Value	-$750,000	$3,411,125	$3,873,875	$3,210,875	$4,960,750	$5,118,500	$5,711,000	$6,303,500	$6,108,500	$5,913,500	$4,931,000

APPENDIX E

ESTIMATED COST OF AERATED STATIC PILE COMPOSTING FACILITY

1. Receiving/Grinding Building (2500 m2)
2. Office Area (350 m2)
3. ASP Bunkers
4. Biofilters (1000 m2)
5. Primary Screening


①
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Developed Area: 35,100 m2

Not Shown:

Curing Area - 92,160 m2

Storge Area – 18000 m2

10m
20m
30m
40m
50m

CH2MHILL

145,000 tpy Outdoor ASP Composting Facility

Conceptual Layout

Order of Magnitude (Class 5) Cost Opinion
September 8, 2010
5180 tpw Outdoor ASP Composting Facility

Description	Qty	Unit	Unit Cost	Total Cost	Subtotals
Site Preparation (~10 m around facility)	35,100				**$850,055**
Common Excavation (0.8 m deep)	28,080	M3	$6.00	$168,480	
Subgrade Preparation	35,100	M2	$2.00	$70,200	
Granular sub-base (75mm minus, 350mm thick)	5,338	M3	$55.00	$293,563	
Granular base (25mm minus, 150mm thick)	2,288	M3	$65.00	$148,688	
Grading and compaction	15,250	M2	$6.50	$99,125	
Utility Allowance	1	LS	$50,000.00	$50,000	
Hydrants	4	EA	$5,000.00	$20,000	
Asphalt Paving (150mm thick)	0	M2	$36.00	$0	
Surface Water Management	2,350				**$38,383**
Common Excavation (wet pond)	2,350	M3	$8.00	$18,800	
Subgrade Preparation	783	M2	$2.00	$1,567	
Storm Pond Liner (supply and install)	901	M2	$20.00	$18,017	
Chain Link Fencing c/w post (6' high)	-	LM	$85.00	$0	
Access Roadways (100 m, 10m wide)	1,000				**$72,800**
Common Excavation (0.8 m deep)	800	M3	$6.00	$4,800	
Subgrade Preparation	1,000	M2	$2.00	$2,000	
Granular sub-base (75mm minus, 350mm thick)	350	M3	$55.00	$19,250	
Granular base (25mm minus, 150mm thick)	150	M3	$65.00	$9,750	
Asphalt Paving (150mm thick)	1,000	M2	$32.00	$32,000	
Culvert (16" dia)	2	LS	$1,000.00	$2,000	
Ditching along roadway	200	LM	$15.00	$3,000	
Receiving and Grinding Building (50m x 50m)	2,500				**$2,198,700**
Excavation for building (0.8m deep)	0	M3	$8.00	$0	
Subgrade Preparation	0	M2	$2.00	$0	
Granular sub-base (75mm minus, 350mm thick)	875	M3	$55.00	$48,125	
Granular base (25mm minus, 150mm thick)	375	M3	$65.00	$24,375	
Grade Beam (250mm x 150mm)	200	LM	$1,200.00	$240,000	
Piles (300 x 300)	34	ea	$1,800.00	$61,200	
Concrete Floor Slab (200mm thick)	500	M3	$360.00	$180,000	
Pre-Engineered Steel Structure with Steel Columns	2,500	M2	$550.00	$1,375,000	
Corrosion Protection (Stayflex)	0	M2	$100.00	$0	
Overhead Vertical Doors	10	EA	$10,000.00	$100,000	
Partioning wall - Concrete Lock blocks	0	LS	$5,000.00	$0	
Rooftop HVAC	3	LS	$15,000.00	$45,000	
Electrical/Mechanical Allowance	2,500	M2	$50.00	$125,000	
Office/Washroom Building	350				**$757,850**
Excavation for building (0.8m deep)	0	M3	$8.00	$0	
Subgrade Preparation	0	M2	$2.00	$0	
Granular sub-base (75mm minus, 350mm thick)	123	M3	$55.00	$6,738	
Granular base (25mm minus, 150mm thick)	53	M3	$65.00	$3,413	
Grade Beam (250mm x 150mm)	90	LM	$1,200.00	$108,000	
Piles (300 x 300)	15	ea	$1,800.00	$27,000	
Concrete Floor Slab (200mm thick)	70	M3	$360.00	$25,200	
Pre-Engineered Steel Structure with Steel Columns	350	M2	$550.00	$192,500	
Interior Walls/Finishing/Fixtures	350	M2	$1,000.00	$350,000	
Overhead Vertical Doors	0	EA	$14,500.00	$0	
Rooftop HVAC	1	LS	$10,000.00	$10,000	
Electrical/Mechanical Allowance	350	M2	$100.00	$35,000	
Composting System (15 @ 20m x 50m)	15,000				**$3,023,480**
Excavation (0.8m deep)	0	M3	$8.00	$0	
Subgrade preparation	0	M2	$2.00	$0	
Granular sub-base (75mm minus, 350mm thick)	5,250	M3	$55.00	$288,750	
Granular base (25mm minus, 150mm thick)	2,250	M3	$65.00	$146,250	
Concrete Floor Slab (200mm thick with Air system)	3,000	M3	$650.00	$1,950,000	
250mm CIP Concrete Side Walls (50m x 2.5m high x 17 walls)	530	M3	$360.00	$190,800	
250mm CIP Concrete End Walls (20m x 2.5m high x 15 walls)	188	M3	$360.00	$67,680	
850mm Boss 2000 Above-grade Distribution Main	300	LM	$250.00	$75,000	
Process Air Fans w/ VFD	4	EA	$20,000.00	$80,000	
Process Electrical/Mechanical Allowance	1	LS	$125,000.00	$125,000	
Process Instrument and Controls	1	LS	$100,000.00	$100,000	
BioFilters (2 @ 1000m2 ea)	2,000				**$509,580**
Excavation for Biofilter (0.8m deep)	0	M3	$8.00	$0	
Subgrade Preparation	0	M2	$2.00	$0	
Granular sub-base (75mm minus, 350mm thick)	700	M3	$55.00	$38,500	
Granular base (25mm minus, 150mm thick)	300	M3	$65.00	$19,500	
Concrete Floor Slab (200mm thick with Air system)	400	M3	$650.00	$260,000	
Concrete Curb Wall around Floor Slab (150mm high)	280	LM	$61.00	$17,080	
Acid Scrubber Allowance	0	LS	$50,000.00	$0	
850mm Boss 2000 Distribution Main	100	LM	$250.00	$25,000	
Valves, Stainless Steel Hardware	2	LS	$20,000.00	$40,000	
50mm Minus Washed Rounded Drain Rock (350 mm thick)	700	M3	$85.00	$59,500	
Wood Chip Biofilter Media (1.25 m thick)	2,500	M3	$20.00	$50,000	

Order of Magnitude (Class 5) Cost Opinion
September 8, 2010
5180 tpw Outdoor ASP Composting Facility

Description	Qty	Unit	Unit Cost	Total Cost	Subtotals
Windrow Composting/Curing and Product Storage Pad	27,360				**$1,272,812**
Clearing and Grubbing	27,360	M2	$1.00	$27,360	
Excavation for Pad (0.8 m deep)	21,888	M3	$8.00	$175,104	
Sub-grade Finishing and compaction	27,360	M2	$2.50	$68,400	
Clay Supply	0	M3	$5.00	$0	
Clay Liner (10-7 cm/s, 0.5m thick)	13,680	M3	$20.00	$273,600	
Geotextile Barrier (supply and install)	27,360	M2	$7.00	$191,520	
Granular base (25mm minus, 300mm thick)	8,208	M3	$65.00	$533,520	
Ditching around pad	662	LM	$5.00	$3,308	
Subtotal					**$8,723,661**
Contractor O/H and Margin	1	PER	10%	872,366.05	**$873,000**
Probable Construction Cost					**$9,596,661**
Equipment					**$2,340,000**
Testing and Monitoring Equipment	1	LS	$10,000	$10,000	
Horizontal Grinder	1	EA	$450,000	$450,000	
Stationary Boom Crane	1	EA	$300,000	$300,000	
Yard Truck	1	EA	$125,000	$125,000	
Walking Floor Trailer	1	EA	$100,000	$100,000	
Windrow Turner	1	LS	$350,000	$350,000	
Final Product Screen	1	LS	$275,000	$275,000	
Stacking Conveyor 60'	1	LS	$80,000	$80,000	
Wheel Loader	2	EA	$325,000	$650,000	
Contingency (excluding Equipment Costs)					**$2,974,965**
Design Allowances based on Conceptual Design	1	PER	30%	$2,878,998	
Market Adjustment Factor	1	PER	1%	$95,967	
Escalation	1	PER	0%	$0	
Design and Construction Management Fees					**$1,099,826**
Engineering Design Fee	1	PER	20%	$594,993	
Construction Management Fee	1	PER	5.0%	$479,833	
Geotechnical Investigations	1	LS	$25,000.00	$25,000	
Total Probable Cost					**$16,011,451**

Notes:

The budget is based on 2nd quarter 2010 Calgary Rates. The estimate is prepared with due diligence with the available information and under normal operations. However this should be subject to market demands and circumstances especially in view of the escalation costs in the lower mainland with ongoing numerous mega projects. The possibility of securing a competive bid process is questionable and should be taken into consideration.

Factors that may affect the estimate on the following issues include escalation, premium on labour, engineering.

The final cost do the project will be subject to labour rates (currently under negotitation), material cost, actual site conditions, availability of labour, material and equipment, final project scope, final project schedule (flexible or fixed), public consultation and input, and other mitigating factors (e.g. timing of construction and award). As a result, the final project cost may defer from the presented budget. Due to facts mentioned, the funding of the project should be carefully reviewed prior to establishing the final budget.

Exclusions:

Equipment specifications not identified.
GST not included
Municipal tees & Licences not included
As the design is at conceptual stage, the tie-ins to existing equipment and facilities have not being identified.